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Linn Street Exchange RAD Conversion Renovations

Solicitation No. 2025-3018

CMHA

Cincinnati Metropolitan Housing Authority

1627 Western Avenue
Cincinnati, OH 45214

PROJECT MANUAL

3244 Fairfield Ave ■ Cincinnati, OH 45207 ■ www.envisage-arch.com ■ 513.409.0609

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1. BID DOCUMENTS

CMHA Linn Street Exchange - Solicitation No. 2025-3018

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INVITATION FOR BIDS
SCHEDULE AND INSTRUCTIONS

CINCINNATI METROPOLITAN HOUSING AUTHORITY

SOLICITATION 2025-3018: Linn St. Exchange RAD Conversion Renovations

PROJECT MANUAL

DATE ISSUED	July 21, 2025
OPTIONAL SITE VISIT/WALK THROUGH	**July 29, 2025 @ 10:30** **1505 Jones St., Cincinnati, OH** It is suggested that the attendees have read the Scope of Work
LAST DATE FOR QUESTIONS	Questions shall be submitted in writing to michael.koch@cintimha.com. Responses to questions will be posted as an addendum to the website along with the other solicitation documents.
PROPOSAL SUBMITTAL DEADLINE & PUBLIC OPENING	**Bid due date: August 19, 2025 @ 10:00a.m** **Sealed Hard Copy Bids** must be delivered to: Cincinnati Metropolitan Housing Authority 1627 Western Ave. Cincinnati OH 45214
WHAT TO SUBMIT	Bid Package MUST include the following documents: 1. Bid Form 2. Bid Bond 3. Non-Collusive Affidavit 4. Disclosure of Lobbying Activities, 5. Form HUD-2530, 6. Form HUD-5369A
NOTICE OF INTENT TO SUBMIT	It is suggested that interested companies submit a Notice of Intent to submit a proposal to procurement@cintimha.com. By indicating your intent to submit a proposal you will receive notice of any addenda posted.
CONSTRUCTION TIME	**420** Calendar days from the date stated in the "Notice to Proceed"

CMHA Reserves the right to modify this schedule at its discretion.

1. In 2012, CMHA established its Gold Performance Standards which consist of the principles and values by which the Agency performs and how our partners, vendors, contractors and consultants are measured.

   The Gold Performance Standards are: Respect, Timely, Exceptional, Initiative, Excellent, Quality, Accurate, Integrity, Value, Creativity, Accountability and Professionalism.

   It is CMHA's intent to procure Contractors that share these standards and can clearly demonstrate the services they can provide CMHA that no other contractor can offer. It's very imperative that our partners, vendors, contractors and consultants abide by these standards that have been established.

2. The Contractor shall hold the offer for 330 days after Bid Due Date

3. Notification of changes in the form of Addendums will be made available to all interested parties via an email and/or by posting on CMHA's website.

4. Only the documents stated on the Solicitation as required will be evaluated. DO NOT include additional documents like, but not limited to: references, licenses, curriculum vitae, previous job pictures. Submitting additional documents may cause the proposal to be unresponsive.

5. This project is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended. Preference may be given in accordance with 24 CFR 135 and the CMHA procurement policy.

6. The Prevailing Wages shall be paid for a legal day's work to laborers, workmen or mechanics engaged in work under this Contract, at the site of the Project, in the trade or occupation listed.

7. The Authority reserves the right to reject and not consider any proposal that does not meet the requirements of this Solicitation, including but not necessarily limited to incomplete proposals and/or proposals offering alternate or non-requested services, proposals deemed non-responsive, respondents deemed not responsible, and conditional proposals.

8. The responsibility for submitting a response to this request at the designated office of the Cincinnati Metropolitan Housing Authority on or before the stated time and date will be solely and strictly of the Proposer. The Authority will in no way be responsible for the delays caused by the delivery manner chosen by the respondent or caused by any other occurrence.

END OF CONDITIONS

INVITATION FOR BIDS
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SOLICITATION No. 2025-3018 - PROPOSAL

TO THE CINCINNATI METROPOLITAN HOUSING AUTHORITY (CMHA)

In submitting this proposal,_____understands that the right is reserved by the Cincinnati Metropolitan Housing Authority to reject any and all Proposals. If written notice of the acceptance of this proposal is mailed, telegraphed or delivered to the undersigned within 250 days after the opening thereof, or at any time thereafter before this proposal is withdrawn, the undersigned agrees to execute and deliver a contract in the prescribed form and furnish the required bond and insurance certifications no later than 10 days after the "Notice of Intent".

1. Total Proposal Amount (TPA)

The base proposal to include all work indicated, administrative costs and Addendums, is

_____
Figure

_____Dollars.
Words

Note: The Total Proposal Amount shall be shown in both words and figures; in case of discrepancy, the amount in words shall govern. To be valid proposal, the Fee Submission Form must be filled out in its entirety with all certifications and affidavits. It must be submitted with and is part of the Proposal Packet.

Attached hereto is an affidavit in proof that the undersigned has not entered into any collusion with any person in respect to this proposal or any other proposal or the submitting of Proposals for the contract for which this proposal is submitted. Also attached is a completed Form HUD-5369-A, Representations, Certifications, and Other Statements of Bidders.

Work under this Contract will begin immediately upon the successful Contractor's receipt of a "Notice to Proceed" from CMHA. The "Notice to Proceed" will follow the completion of an executed contract.

2. Alternate Bid

An Alternate Bid or Alternate is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted. Any alternates accepted by the owner shall be accepted in the order in which they are listed in the form of Bid.

DEDUCT D01:	Sitework, parking lot repair	$_____
DEDUCT D02:	Masonry Cleaning	$_____
DEDUCT D03:	Sitework – fence repair	$_____

DEDUCT D04: Remove new work within Mercantile space level 1, as noted on the drawings.

$_____

DEDUCT D05: Remove window fall protection upgrades. $_____

DEDUCT D06: Replace mailboxes $_____

DEDUCT D07: Remove new solids surface countertop and repair damage plastic laminate countertops as noted. And provide price per lsf for counters that can not be repaired as confirmed by CMHA and/ or Architect. $_____

DEDUCT D08 Remove replace bathroom vanity cabinet in its entirety and replace with replace vanity counter only, vanity cabinet to remain, unless notes otherwise. Provide price per unit to replace cabinet. $_____

3. Unit Costs

Unit costs shall be inclusive of materials, labor, overhead and profit. The unit prices offered will be used to increase or decrease the Total Contract Amount based on the existing conditions determined by the Owner at the time of construction of any given building. No unit prices may be used without the written permission of the Owner. CMHA has the right to reject any proposal which indicates an unbalanced proposal or prices.

1. Repair sub floor: $/sf _____
2. Subfloor seal: $/ sf _____
3. Roof substrate repair: $/sf _____
4. Replace wet or removed insulation: $/sf _____
5. Repair damaged joist: $/lf _____
6. Replace countertops: $/lf _____
7. Roof repair: $/sf _____

4. Bid Bond

A Bid Bond of 10% of the Total Proposal Amount is included in the Proposal

_____
Figure
_____Dollars.

Words

All bid bonds be a shall be issued by Surety Companies licensed to issue bonds in the State of Ohio and listed in Federal Register Circular #570. The current power of attorney for the person who signs for any surety company shall be attached to the bid bond.

The CMHA will have the right to retain the bid security of bidders to whom an award is being considered until either (a) the contract has been executed and bonds, if required, have been executed, (b) the specified time has elapsed so that bids may be withdrawn, or (c) all bids have been rejected.

5. Acknowledgment's

I acknowledge receipt and acceptance of the following:

- Scope of Work
- General Contract Conditions (HUD-5370)
- MBE/WBE Participation Report
- S3 Residents and Business Concerns
- Prevailing Wages Clause
- Wage Determination Rates
- Addendum No. Dated:
- Addendum No. Dated:
- Addendum No. Dated:

6. Basis of Contract Award

CMHA intends to award this contract to the Lowest Responsive Bidder complying with these Public Bid Specifications, Drawings and Addenda, if any, provided the Contractor's proposal is reasonable and in the best interest of CMHA to accept it.

7. Contract Time

The contract performance period from the "Notice to Proceed" until Substantial Completion, will be

420 Calendar Days.

8. Assurance of Compliance

The successful Bidder shall furnish an assurance of completion prior to the execution of any contract under this solicitation in the form of a performance and payment bond in a penal sum of 100 percent of the contract price.

9. Minority Business Enterprise (MBE) & Women Business Enterprise(WBE)

The contractor agrees to make its best effort to expend at least 20% of the total dollar amount of the Contract on Minority Business Enterprises (MBE), an entity with at least 51% ownership interest by a minority in business), and at least 5% of the Contract to a Women Business Enterprises (WBE), an entity with a least 51% ownership interest by a woman in business.

Prior to award of Contract, the Contractor will submit documents in support of its best efforts to achieve the above stated MBE/WBE participation. Best efforts may be established by documenting that the Contractor:

- Has made efforts to identify appropriate MBE/WBE contractors through community contacts or MBE and WBE associations.
- Has contacted CMHA's Economic Inclusion Coordinator to help identify potential
- MBE/WBE companies appropriate for the project.
- Has contacted and solicited proposals/Proposals from selected MBE/WBE companies.

Contractors agrees to promptly complete and return all required reports confirming MBE/WBE participation, including Proposed, Amended, and Final MBE/WBE Participation Forms. If requested by CMHA, the Contractor agrees to submit proof of payment made to each MBE/WBE subcontractor listed on the MBE/WBE Participation Report.

Request for complete or partial waiver of the contractor's MBE/WBE participation goals must be made in writing, stating all details in the request, the circumstances, and all relevant information. The request must be accompanied by a record of all efforts taken by the Bidder/Bidder to locate MBE/WBEs, solicit MBE/WBEs, seek assistance from CMHA's Economic Inclusion Coordinator, or seek help from other community/business resources or technical assistance agencies. CMHA will respond in writing to the Waiver Request within five (5) business days upon receipt.

10. Section 3 Certification of Preference

Please note that a contract with the Cincinnati Metropolitan Housing Authority is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended and to the Section 3 Action Plan submitted with the proposal for this project.

Type of Business (circle all that apply)

☐ Corporation	☐ Partnership	☐ Sole Proprietorship	☐ Joint Venture
☐ LLC	☐ MBE	☐ WBE	☐

You self-certify that your business has documented within the last six months a Section 3 Business Concern based on one of the eligibility criteria below. (Check the one that qualifies your business):

- ☐ **Category 1:** 51 percent or more owned and controlled by low- or very low-income people (based on household income under HUD-income limits)
- ☐ **Category 2:** 75 percent or more of the business labor hours to perform the business are performed by low-very low-income people.
- ☐ **Category 3:** 51 percent owned and controlled by current residents of public housing or

Section 8-assisted housing.

- ☐ My business does not meet the Section 3 eligibility criteria and wishes to forgo Section 3 preferences in the awarding of this contract but understand that we are still responsible for meeting Section 3 compliance.

11. Section 3 – Action Plan

Please check any and all efforts from the below mentioned categories that your company will utilize to:

- ☐ Recruit, solicit, encourage, facilitate and hire Section 3 Workers when new hiring/training opportunities are generated through the awarding of the contract.
- ☐ Recruit, solicit, encourage, facilitate and Subcontract with Section 3 Business Concerns when new subcontracting opportunities are generated through the awarding of the contract.

Your acknowledgment is still needed, so please check accordingly. The Section 3 Action Plan is subject to audit at any time during the awarding of the contract through the duration of the contract by the Section 3 Compliance Coordinator

You are required to the provide opportunities to "the greatest extent feasible" in order to comply with the requirements of Section 3. In the event that you are not able to hire/train and/or contract with Section 3 Residents and/or Section 3 Business Concerns, you will be required to document why you were unable to meet the numerical goals.

a. Opportunities Strategies - Hiring / Training

- **Mandatory** Commit that the company and/or subcontractors as a result of the contract, 25% of the labors hours will be Section 3 Workers.
- **Mandatory** Contact the CMHA Section 3 Compliance Coordinator regarding
- employment and training opportunities.
- **Mandatory** Provide the CMHA Section 3 Compliance Coordinator with a monthly report listing all employment and training opportunities.
- **Mandatory** Post notice (placards) at the worksite where the work is being done,
- indicating any employment and training opportunities
- Facilitate or co-facilitate Hiring Halls within close proximity to where the work is being done for Section 3 Workers and Tags.
- Contact/Meet with Resident Associations informing them of new training and
- employment opportunities.
- Advertise new training and employment opportunities in community and diversity newspapers/websites.
- Sponsor or participate in job informational meetings or job fairs in the neighborhood or
- service area of the Section 3 covered project.
- Establish an internal training program (pre-apprenticeship) that is consistent with Dept. of Labor requirements to provide Section 3 Workers with the opportunity to learn skills and job requirements.
- Distribute flyers to CMHA owned sites indicating the number and types of jobs that will be offered with contact information.
- Maintain a file of eligible qualified Section 3 Workers and Targeted Section 3 Workers
- for future employment opportunities.

- Incorporate into contract (after selection of Bidders but prior to the execution of contracts), a negotiated provision for a specific number of Section 3 Workers to be trained and/or employed during the contract.
- Other:

_____

_____

b. Opportunities Strategies - Subcontracting

- **Mandatory** Contact the CMHA Section 3 Compliance Coordinator regarding all new subcontracting opportunities.
- **Mandatory** Provide the CMHA Section 3 Compliance Coordinator with a monthly report
- listing all subcontracting opportunities.
- Advertise new contracting opportunities in community and diversity newspapers/websites.
- Maintain a file of eligible qualified Section 3 Business Concerns for future contracting opportunities.
- Incorporate into contract (after selection of Bidders but prior to the execution of contracts), a negotiated provision for a specific amount of work to be contracted with Section 3 Business Concern(s) during the contract.
- Sponsor or participate in minority, women, small business expositions and or conferences in the Cincinnati, Ohio area to network and promote contracting opportunities with Section 3 Business Concern
- Outreach to business assistance agencies, minority contracting associations, community organizations, to network and promote contracting opportunities with Section 3 Business Concerns.
- Contact/Meet with Resident Associations informing them of new contracting opportunities.
- Outreach to trade/labor organizations to network and promote contracting opportunities
- with Section 3 Business Concerns.
- Host/Facilitate workshops geared to Section 3 Business concerns on contracting procedures and opportunities.
- Become an active mentor to Section 3 Business Concerns.
- Other:

_____

_____

INVITATION FOR BIDS
BID BOND SAMPLE

The undersigned is familiar with the local conditions, regulations and codes affecting the cost of the work, and with the Drawings and Specifications, issued and Addenda, if any thereto.

The penalty for making false statements in any offer is prescribed in 19 U.S.C. 1001.
FILL WITH LEGIBLE BLOCK LETTERS

Amount:_____

Legal Business Name: _____

DBA Name (If Applicable): _____

Business Address: _____

City, State, Zip: _____

Fed. Tax ID: _____

Business SAM.gov Unique Entity ID: _____

Email / Phone No.: _____

Signature:_____

Name:_____

Title: _____

Direct to Section3@cintimha.com any questions regarding CMHA's:

- MBE/WBE Program
- Section 3 Business Concerns

KNOWN ALL MEN BY THESE PRESENTS, that we:

_____

(Insert full name and address or legal title of Contractor) as

Principal, hereinafter called the principle, and:

_____

(Insert full name and address or legal title of Surety)

a corporation duly organized under the laws of the State of:

_____as Surety, hereinafter called the Surety,

are held and firmly bound unto:

SAMPLE

(Insert full name and address or legal title of Owner) hereinafter called

the Obligee, in the sum of (10% of Bid):

_____DOLLARS
(In Words)

$_____

for payment of which sum, well and truly to be made, we hereby jointly bind ourselves, our heirs, executors, administrators, successors and assigns. The CONDITION OF THIS OBLIGATION IS SUCH, that whereas, the Principal has submitted the accompanying bid, dated:

_____20_____for _____

_____

NOW, THEREFORE, if the Obligee shall accept the Bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such Bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference between the amount specified in said Bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bond, then this obligation shall be null and void, otherwise to remain in full force andeffect.

SIGNED SEALED ANDDATED THIS_____DAY OF_____, 20_____

_____ _____
WITNESS PRINCIPAL

BY_____

_____
SURETY

BY_____

Note: In lieu of such bond, the Bidder shall include with his proposal, a Certified Check, Bank Draft, or U.S. Government Bond at par value, payable to the Obligee.

Certified Check for_____

DOLLARS - ON_____BANK OF _____

_____DEPOSITED HEREWITH

_____
BIDDER

BY_____

_____
TITLE

SAMPLE

TO THE CINCINNATI METROPOLITAN HOUSING AUTHORITY (CMHA)

State of _____

County of _____

_____, being first sworn, deposes:

and says that he is □ sole owner, □ partner, □ other_____of

(Firm Name) _____

the party making the foregoing proposal or bid, that such proposal or bid is genuine and not collusive or sham; that aspired, connived or agreed, directly or indirectly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly, or indirectly, sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of affiant or of any other bidder, or to fix any overhead, profit or cost element of said bid price, to secure any advantage against the Cincinnati Metropolitan Housing Authority or any person interested in the proposed contract; and that all statements in said proposal or bid are true.

_____

Signature of Bidder: (If Individual)

_____

Signature of Bidder: (If Partnership)

_____

Signature of Bidder: (If Corporation)

Subscribed and sworn to before me this_____day of_____, 20_____

_____ My commission expires_____, 20____Notary Public

FOR CONTRACTS, GRANTS, LOANS AND COOPERATIVE AGREEMENTS

The undersigned certifies, to the best of his or her knowledge and belief that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL "Disclosure Form to Report Lobbying," in accordance with its instructions.

3. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Fill with legible block letters

Signature:_____

Name:_____

Title:_____

Date: _____

Covered Action: _____

Type and identify program, project or activity

Previous Participation Certification

OMB Approval No. 2502-0118
(Exp. 05/31/2019)

US Department of Housing and Urban Development
Office of Housing/Federal Housing Commissioner

US Department of Agriculture
Farmers Home Administration

Part I to be completed by Principals of Multifamily Projects *(See instructions)* Reason for submission:		**For HUD HQ/FmHA use only**	
1. Agency name and City where the application is filed		**2**. Project Name, Project Number, City and Zip Code	
3. Loan or Contract amount $	**4**. Number of Units or Beds	**5**. Section of Act	**6**. Type of Project (check one) ☐ Existing ☐ Rehabilitation ☐ Proposed (New)

7. List all proposed Principals and attach organization chart for all organizations

Name and address of Principals and Affiliates (Name: Last, First, Middle Initial) proposing to participate	**8 Role of Each Principal in Project**	**9. SSN or IRS Employer Number**

Certifications: The principal(s) listed above hereby apply to HUD or USDA FmHA, as the case maybe, for approval to participate as principal(s) in the role(s) and project listed above. The principal(s) each certify that all the statements made on this form are true, complete and correct to the best of their knowledge and belief and are made in good faith, including any Exhibits attached to this form. **Warning:** HUD will prosecute false claims and statements. Conviction may result in criminal and/or civil penalties. The principal(s) further certify that to the best of their knowledge and belief:

1. Schedule A contains a listing, for the last ten years, of every project assisted or insured by HUD, USDA FmHA and/or State and local government housing finance agencies in which the principal(s) have participated or are now participating.
2. For the period beginning 10 years prior to the date of this certification, and except as shown on the certification:

a. No mortgage on a project listed has ever been in default, assigned to the Government or foreclosed, nor has it received mortgage relief from the mortgagee;
b. The principals have no defaults or noncompliance under any Conventional Contract or Turnkey Contract of Sale in connection with a public housing project;
c. There are no known unresolved findings as a result of HUD audits, management reviews or other Governmental investigations concerning the principals or their projects;
d. There has not been a suspension or termination of payments under any HUD assistance contract due to the principal's fault or negligence;
e. The principals have not been convicted of a felony and are not presently the subject of a complaint or indictment charging a felony. (A felony is defined as any offense punishable by imprisonment for a term exceeding one year, but does not include any offense classified as a misdemeanor under the laws of a State and punishable by imprisonment of two years or less);
f. The principals have not been suspended, debarred or otherwise restricted by any Department or Agency of the Federal Government or of a State Government from doing business with such Department or Agency;
g. The principals have not defaulted on an obligation covered by a surety or performance bond and have not been the subject of a claim under an employee fidelity bond;

3. All the names of the principals who propose to participate in this project are listed above.
4. None of the principals is a HUD/FmHA employee or a member of a HUD/FmHA employee's immediate household as defined in Standards of Ethical Conduct for Employees of the Executive Branch in 5 C.F.R. Part 2635 (57 FR 35006) and HUD's Standard of Conduct in 24 C.F.R. Part 0 and USDA's Standard of Conduct in 7 C.F.R. Part 0 Subpart B.
5. None of the principals is a participant in an assisted or insured project as of this date on which construction has stopped for a period in excess of 20 days or which has been substantially completed for more than 90 days and documents for closing, including final cost certification, have not been filed with HUD or FmHA.
6. None of the principals have been found by HUD or FmHA to be in noncompliance with any applicable fair housing and civil rights requirements in 24 CFR 5.105(a). (If any principals or affiliates have been found to be in noncompliance with any requirements, attach a signed statement explaining the relevant facts, circumstances, and resolution, if any).
7. None of the principals is a Member of Congress or a Resident Commissioner nor otherwise prohibited or limited by law from contracting with the Government of the United States of America.
8. Statements above (if any) to which the principal(s) cannot certify have been deleted by striking through the words with a pen, and the relevant principal(s) have initialed each deletion (if any) and have attached a true and accurate signed statement (if applicable) to explain the facts and circumstances.

Name of Principal	**Signature of Principal**	**Certification Date(mm/dd/yyyy**	**Area Code and Tel. No.**
This form prepared by (print name)		**Area Code and Tel. No.**	

IFB Project Manual Rev. 1 (10/24)

Schedule A: List of Previous Projects and Section 8 Contracts. Below is a complete list of the principals' previous participation projects and participation history in multifamily Housing programs of HUD/FmHA, State and local Housing Finance Agencies. **Note:** Read and follow the instruction sheet carefully. Make full disclosure. Add extra sheets if you need more space. Double check for accuracy. If no previous projects, write by your name, "**No previous participation, First Experience"**.

1. Principals Name (Last, First)	2. List of previous projects (Project name, project ID and, Govt. agency involved)	3.List Principals' Role(s) (indicate dates participated, and if fee or identity of interest participant)	4. Status of loan (current, defaulted, assigned, foreclosed)	5.Was the Project ever in default during your participation **Yes**	**No**	**If yes, explain**	6. Last MOR rating and Physical Insp. Score and date

Part II- For HUD Internal Processing Only

Received and checked by me for accuracy and completeness; recommend approval or refer to Headquarters after checking appropriate box.

Date (mm/dd/yyyy)	Tel No. and area code	☐A. No adverse information; form HUD-2530 approval recommended.	C. Disclosure or Certification problem
Staff	Processing and Control	☐B. Name match in system	D. Other (attach memorandum)

Supervisor	Director of Housing/Director, Multifamily Division	Approved ☐ Yes ☐ No	Date (mm/dd/yyyy)

IFB Project Manual Rev. 1 (10/24)

Instructions for Completing the Previous Participation Certificate, form HUD-2530

Carefully read these instructions and the applicable regulations. A copy of those regulations published at 24 C.F.R. 200.210 to 200.245 can be obtained from the Multifamily Housing Representative at any HUD Office. Type or print neatly in ink when filling out this form. Mark answers in all blocks of the form. If the form is not filled completely, it will delay approval of your application.

Attach extra sheets as you need them. Be sure to indicate "Continued on Attachments" wherever appropriate. Sign each additional page that you attach if it refers to you or your record.

Carefully read the certification before you sign it. Any questions regarding the form or how to complete it can be answered by your HUD Office Multifamily Housing Representative.

Purpose: This form provides HUD with a certified report of all previous participation in HUD multifamily housing projects by those parties making application. The information requested in this form is used by HUD to determine if you meet the standards established to ensure that all principal participants in HUD projects will honor their legal, financial and contractual obligations and are acceptable risks from the underwriting standpoint of an insurer, lender or governmental agency. HUD requires that you certify your record of previous participation in HUD/USDA-FmHA, State and Local Housing Finance Agency projects by completing and signing this form, before your project application or participation can be approved.

HUD approval of your certification is a necessary precondition for your participation in the project and in the capacity that you propose. If you do not file this certification, do not furnish the information requested accurately, or do not meet established standards, HUD will not approve your certification.

Note that approval of your certification does not obligate HUD to approve your project application, and it does not satisfy all other HUD program requirements relative to your qualifications.

Who Must Sign and File Form HUD-2530:

Form HUD-2530 must be completed and signed by all principals applying to participate in HUD multifamily housing projects, including those who have no previous participation. The form must be signed and filed by all principals and their affiliates who propose participating in the HUD project. Use a separate form for each role in the project unless there is an identity of interest.

Principals include all individuals, joint ventures, partnerships, corporations, trusts, non-profit organizations, any other public or private entity that will participate in the proposed project as a sponsor, owner, prime contractor, turnkey developer, managing agent, nursing home administrator or operator, packager, or consultant. Architects and attorneys who have any interest in the project other than an arm's length fee arrangement for professional services are also considered principals by HUD.

In the case of partnerships, all general partners regardless of their percentage interest and limited partners having a 25 percent or more interest in the partnership are considered principals. In the case of public or private corporations or governmental entities, principals include the president, vice president, secretary, treasurer and all other executive officers who are directly responsible to the board of directors, or any equivalent governing body, as well as all directors and each stockholder having a 10 percent or more interest in the corporation.

Affiliates are defined as any person or business concern that directly or indirectly controls the policy of a principal or has the power to do so. A holding or parent corporation would be an example of an affiliate if one of its subsidiaries is a principal.

Exception for Corporations – All principals and affiliates must personally sign the certificate except in the following situation. When a corporation is a principal, all of its officers, directors, trustees and stockholders with 10 percent or more of the common (voting) stock need not sign personally if they all have the same record to report. The officer who is authorized to sign for the corporation or agency will list the names and title of those who elect not to sign. However, any person who has a record of participation in HUD projects that is separate from that of his or her organization must report that activity on this form and sign his or her name. The objective is **full** disclosure.

Exemptions – The names of the following parties do not need to be listed on form HUD-2530: Public Housing Agencies, tenants, owners of less than five condominium or cooperative units and all others whose interests were acquired by inheritance or court order.

Where and When Form HUD-2530 Must Be Filed: The original of this form must be submitted to the HUD Office where your project application will be processed at the same time you file your initial project application. This form must be filed with applications for projects, or when otherwise required in the situations listed below:

- Projects to be financed with mortgages insured under the National Housing Act (FHA).
- Projects to be financed according to Section 202 of the Housing Act of 1959 (Elderly and Handicapped).
- Projects in which 20 percent or more of the units are to receive a subsidy as described in 24 C.F.R. 200.213.
- Purchase of a project subject to a mortgage insured or held by the Secretary of HUD.
- Purchase of a Secretary-owned project.
- Proposed substitution or addition of a principal or principal participation in a different capacity from that previously approved for the same project.
- Proposed acquisition by an existing limited partner of an additional interest in a project resulting in a total interest of 25 percent or more or proposed acquisition by a corporate stockholder of an additional interest in a project resulting in a total interest of 10 percent or more.
- Projects with U.S.D.A., Farmers Home Administration, or with state or local government housing finance agencies that include rental assistance under Section 8 of the Housing Act of 1937. For projects of this type, form HUD-2530 should be filed with the appropriate applications directly to those agencies.

Review of Adverse Determination: If approval of your participation in a HUD project is denied, withheld, or conditionally granted on the basis of your record of previous participation, you will be notified by the HUD Office. You may request reconsideration by the HUD Review Committee. Alternatively, you may request a hearing before a Hearing Officer. Either request must be made in writing within 30 days from your receipt of the notice of determination.

If you do request reconsideration by the Review Committee and the reconsideration results in an adverse determination, you may then request a hearing before a Hearing Officer. The Hearing Officer will issue a report to the Review Committee. You will be notified of the final ruling by certified mail.

Specific Line Instructions:

Reason for submitting this Certification: e.g., refinance, change in ownership, change in management agent, transfer of physical assets, etc.

Block 1: Fill in the name of the agency to which you are applying. For example: HUD Office, Farmers Home Administration District office, or the name of a State or local housing finance agency. Below that, fill in the name of the city where the office is located.

Block 2: Fill in the name of the project, such as "Greenwood Apts." If the name has not yet been selected, write "Name unknown." Below that, enter the HUD contract or project identification number, the Farmers Home Administration project number, or the State or local housing finance agency project or contract number. Include **all** project or contract identification numbers that are relevant to the project. Also enter the name of the city in which the project is located, and the ZIP Code.

Block 3: Fill in the dollar amount requested in the proposed mortgage, or the annual amount of rental assistance requested.

Block 4: Fill in the number of apartment units proposed, such as "40 units." For hospital projects or nursing homes, fill in the number of beds proposed, such as "100 beds."

Block 5: Fill in the section of the Housing Act under which the application is filed.

Block 7: Definitions of all those who are considered principals and affiliates are given above in the section titled "Who Must Sign and File "

Block 8: Beside the name of each principal, fill in the appropriate role. The following are examples of possible roles that the principals may assume: Owner/Mortgagor, Managing Agent, Sponsor, Developer, General Con-tractor, Packager, Consultant, Nursing Home Administrator etc.

Block 9 : Fill in the Social Security Number or IRS employer number of every principal listed, including affiliates.

Instructions for Completing Schedule A:

Be sure that Schedule A is filled-in completely, accurately and the certification i s properly dated and signed, because it will serve as a legal record of your previous experience. All Multifamily Housing projects involving HUD/ FmHA, and State and local Housing Finance Agencies in which you have previously participated **must be** listed. Applicants a r e reminded that previous participation pertains to the individual principal within an entity as well as the entity itself. A newly formed company may not have previous participation, but the principals within the company may have had extensive participation and disclosure of that activity is required.

Column 2. ***All previous projects must be listed or your certification cannot be processed.*** Include the name of all projects, project number, city where it is located and the governmental agency (HUD, USDA-FmHA or state or local housing finance agency) that was involved.

Column 3. List the role(s) as a principal, dates participated and if fee or identity of interest (IOI) with owners.

Column 4. Indicate the current status of the loan. Except for current loan, the date associated with the status is required. Loans under a workout arrangement are considered assigned. For all noncurrent loans, an explanation of the status is required.

Column 5. Explain any project defaults during your participation.

Column 6. Provide the latest Management Review (MOR) rating and Physical Inspection score.

Certification: After you have completed all other parts of form HUD-2530, including schedule A, read the Certification carefully. In the box below the statement of the certification, fill in the names of all principals and affiliates as listed in block 7. Each principal should sign the certification with the exception in some cases of individuals associated with a corporation (see "Exception for Corporations" in the section of the instructions titled "Who Must Sign and File Form HUD-2530). Principal who is signing on behalf of the entity should attach signature authority document. Each principal who signs the form should fill in the date of the signature and a telephone number. By providing a telephone number, HUD can reach you in the event of any questions.

If you cannot certify and sign the certification as it is printed because some statements do not correctly describe your record, use a pen to strike through those parts that differ with your record, and then sign and certify.

Attach a signed statement of explanation of the items you have struck out on the certification. Item 2e. relates to felony convictions within the past 10 years. If you are convicted of a felony within the past 10 years, strike out 2e. and attach statement of explanation. A felony conviction will not necessarily cause your participation to be disapproved unless there is a criminal record or other evidence that your previous conduct or method of doing business has been such that your participation in the project would make it an unacceptable risk from the underwriting stand point of an insurer, lender or governmental agency.

The Department of Housing and Urban Development (HUD) is authorized to collect this information by law (42 U.S.C. 3535(d) and 24 C.F.R. 200.217) and by regulation at 24 CFR 200.210. This information is needed so that principals applying to participate in multifamily programs can become HUD-approved participants. The information you provide will enable HUD to evaluate your record with respect to established standards of performance, responsibility and eligibility. Without prior approval, a principal may not participate in a proposed or existing multifamily project. HUD uses this information to evaluate whether or not principals pose an unsatisfactory underwriting risk. The information is used to evaluate the potential principals and approve only individuals and organizations that will honor their legal, financial and contractual obligations.

Privacy Act Statement: The Housing and Community Development Act of 1987, 42 U.S.C. 3543 requires persons applying for a Federally-insured or guaranteed loan to furnish his/her Social Security Number (SSN). HUD must have your SSN for identification of your records. HUD may use your SSN for automated processing of your records and to make requests for information about you and your previous records with other public agencies and private sector sources. HUD may disclose certain information to Federal, State and local agencies when relevant to civil, criminal, or regulatory investigations and prosecutions. It will not be otherwise disclosed or released outside of HUD, except as required and permitted by law. You must provide all of the information requested in this application, including your SSN.

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. This agency may not collect this information, and you are not required to complete this form, unless it displays a currently valid OMB control number.

A response is mandatory. Failure to provide any of the information will result in your disapproval of participation in this HUD program.

U.S. Department of Housing and Urban Development

Office of Public and Indian Housing

Representations, Certifications, and Other Statements of Bidders

Public and Indian Housing Programs

Representations, Certifications, and Other Statements of Bidders

Public and Indian Housing Programs

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1. Certificate of Independent Price Determination

(a) The bidder certifies that--

(1) The prices in this bid have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other bidder or competitor relating to (i) those prices, (ii) the intention to submit a bid, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this bid have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a competitive proposal solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the bidder to induce any other concern to submit or not to submit a bid for the purpose of restricting competition.

(b) Each signature on the bid is considered to be a certification by the signatory that the signatory--

(1) Is the person in the bidder's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above.

_____ [insert full name of person(s) in the bidder's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the bidder's organization];

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the bidder deletes or modifies subparagraph (a)2 above, the bidder must furnish with its bid a signed statement setting forth in detail the circumstances of the disclosure.

[x] [Contracting Officer check if following paragraph is applicable]

(d) Non-collusive affidavit. (applicable to contracts for construction and equipment exceeding $50,000)

(1) Each bidder shall execute, in the form provided by the PHA/IHA, an affidavit to the effect that he/she has not colluded with any other person, firm or corporation in regard to any bid submitted in response to this solicitation. If the successful bidder did not submit the affidavit with his/her bid, he/she must submit it within three (3) working days of bid opening. Failure to submit the affidavit by that date may render the bid nonresponsive. No contract award will be made without a properly executed affidavit.

(2) A fully executed "Non-collusive Affidavit" [ ] is, [ ] is not included with the bid.

2. Contingent Fee Representation and Agreement

(a) Definitions. As used in this provision:

"Bona fide employee" means a person, employed by a bidder and subject to the bidder's supervision and control as to time, place, and manner of performance, who neither exerts, nor proposes to exert improper influence to solicit or obtain contracts nor holds out as being able to obtain any contract(s) through improper influence.

"Improper influence" means any influence that induces or tends to induce a PHA/IHA employee or officer to give consideration or to act regarding a PHA/IHA contract on any basis other than the merits of the matter.

(b) The bidder represents and certifies as part of its bid that, except for full-time bona fide employees working solely for the bidder, the bidder:

(1) [ ] has, [ ] has not employed or retained any person or company to solicit or obtain this contract; and

(2) [ ] has, [ ] has not paid or agreed to pay to any person or company employed or retained to solicit or obtain this contract any commission, percentage, brokerage, or other fee contingent upon or resulting from the award of this contract.

(c) If the answer to either (a)(1) or (a)(2) above is affirmative, the bidder shall make an immediate and full written disclosure to the PHA/IHA Contracting Officer.

(d) Any misrepresentation by the bidder shall give the PHA/IHA the right to (1) terminate the contract; (2) at its discretion, deduct from contract payments the amount of any commission, percentage, brokerage, or other contingent fee; or (3) take other remedy pursuant to the contract.

3. Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions (applicable to contracts exceeding $100,000)

(a) The definitions and prohibitions contained in Section 1352 of title 31, United States Code, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The bidder, by signing its bid, hereby certifies to the best of his or her knowledge and belief as of December 23, 1989 that:

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of a contract resulting from this solicitation;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the bidder shall complete and submit, with its bid, OMB standard form LLL, "Disclosure of Lobbying Activities;" and

(3) He or she will include the language of this certification in all subcontracts at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(d) Indian tribes (except those chartered by States) and Indian organizations as defined in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) are exempt from the requirements of this provision.

4. Organizational Conflicts of Interest Certification

The bidder certifies that to the best of its knowledge and belief and except as otherwise disclosed, he or she does not have any organizational conflict of interest which is defined as a situation in which the nature of work to be performed under this proposed contract and the bidder's organizational, financial, contractual, or other interests may, without some restriction on future activities:

(a) Result in an unfair competitive advantage to the bidder; or,

(b) Impair the bidder's objectivity in performing the contract work.

[ ] In the absence of any actual or apparent conflict, I hereby certify that to the best of my knowledge and belief, no actual or apparent conflict of interest exists with regard to my possible performance of this procurement.

5. Bidder's Certification of Eligibility

(a) By the submission of this bid, the bidder certifies that to the best of its knowledge and belief, neither it, nor any person or firm which has an interest in the bidder's firm, nor any of the bidder's subcontractors, is ineligible to:

(1) Be awarded contracts by any agency of the United States Government, HUD, or the State in which this contract is to be performed; or,

(2) Participate in HUD programs pursuant to 24 CFR Part 24.

(b) The certification in paragraph (a) above is a material representation of fact upon which reliance was placed when making award. If it is later determined that the bidder knowingly rendered an erroneous certification, the contract may be terminated for default, and the bidder may be debarred or suspended from participation in HUD programs and other Federal contract programs.

6. Minimum Bid Acceptance Period

(a) "Acceptance period," as used in this provision, means the number of calendar days available to the PHA/IHA for awarding a contract from the date specified in this solicitation for receipt of bids.

(b) This provision supersedes any language pertaining to the acceptance period that may appear elsewhere in this solicitation.

(c) The PHA/IHA requires a minimum acceptance period of [Contracting Officer insert time period] calendar days.

(d) In the space provided immediately below, bidders may specify a longer acceptance period than the PHA's/IHA's minimum requirement. The bidder allows the following acceptance period: calendar days.

(e) A bid allowing less than the PHA's/IHA's minimum acceptance period will be rejected.

(f) The bidder agrees to execute all that it has undertaken to do, in compliance with its bid, if that bid is accepted in writing within (1) the acceptance period stated in paragraph (c) above or (2) any longer acceptance period stated in paragraph (d) above.

7. Small, Minority, Women-Owned Business Concern Representation

The bidder represents and certifies as part of its bid/ offer that it --

(a) [ ] is, [ ] is not a small business concern. "Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding, and qualified as a small business under the criteria and size standards in 13 CFR 121.

(b) [ ] is, [ ] is not a women-owned business enterprise. "Women-owned business enterprise," as used in this provision, means a business that is at least 51 percent owned by a woman or women who are U.S. citizens and who also control and operate the business.

(c) [ ] is, [ ] is not a minority business enterprise. "Minority business enterprise," as used in this provision, means a business which is at least 51 percent owned or controlled by one or more minority group members or, in the case of a publicly owned business, at least 51 percent of its voting stock is owned by one or more minority group members, and whose management and daily opera- tions are controlled by one or more such individuals. For the purpose of this definition, minority group members are:

(Check the block applicable to you)

[ ] Black Americans
[ ] Hispanic Americans
[ ] Native Americans
[ ] Asian Pacific Americans
[ ] Asian Indian Americans
[ ] Hasidic Jewish Americans

8. Indian-Owned Economic Enterprise and Indian Organization Representation (applicable only if this solicitation is for a contract to be performed on a project for an Indian Housing Authority)

The bidder represents and certifies that it:

(a) [ ] is, [ ] is not an Indian-owned economic enterprise. "Economic enterprise," as used in this provision, means any com- mercial, industrial, or business activity established or organized for the purpose of profit, which is at least 51 percent Indian owned. "Indian," as used in this provision, means any person who is a member of any tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs and any "Native" as defined in the Alaska Native Claims Settlement Act.

(b) [ ] is, [ ] is not an Indian organization. "Indian organization," as used in this provision, means the governing body of any Indian tribe or entity established or recognized by such governing body. Indian "tribe" means any Indian tribe, band, group, pueblo, or

community including Native villages and Native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs.

9. Certification of Eligibility Under the Davis-Bacon Act (applicable to construction contracts exceeding $2,000)

(a) By the submission of this bid, the bidder certifies that neither it nor any person or firm who has an interest in the bidder's firm is a person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of the contract resulting from this solicitation shall be subcontracted to any person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U. S. Criminal Code, 18 U.S.C. 1001.

10. Certification of Nonsegregated Facilities (applicable to contracts exceeding $10,000)

(a) The bidder's attention is called to the clause entitled **Equal Employment Opportunity** of the General Conditions of the Contract for Construction.

(b) "Segregated facilities," as used in this provision, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise.

(c) By the submission of this bid, the bidder certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The bidder agrees that a breach of this certification is a violation of the Equal Employment Opportunity clause in the contract.

(d) The bidder further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) prior to entering into subcontracts which exceed $10,000 and are not exempt from the requirements of the Equal Employment Opportunity clause, it will:

(1) Obtain identical certifications from the proposed subcontractors;

(2) Retain the certifications in its files; and

(3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods):

Notice to Prospective Subcontractors of Requirement for Certifications of Nonsegregated Facilities

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Employment Opportunity clause of the prime contract. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

Note: The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

11. Clean Air and Water Certification (applicable to contracts exceeding $100,000)

The bidder certifies that:

(a) Any facility to be used in the performance of this contract [ ] is, [ ] is not listed on the Environmental Protection Agency List of Violating Facilities:

(b) The bidder will immediately notify the PHA/IHA Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the Environmental Protection Agency, indicating that any facility that the bidder proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and,

(c) The bidder will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

12. Previous Participation Certificate (applicable to construction and equipment contracts exceeding $50,000)

(a) The bidder shall complete and submit with his/her bid the Form HUD-2530, "Previous Participation Certificate." If the successful bidder does not submit the certificate with his/her bid, he/she must submit it within three (3) working days of bid opening. Failure to submit the certificate by that date may render the bid nonresponsive. No contract award will be made without a properly executed certificate.

(b) A fully executed "Previous Participation Certificate"

[ ] is, [ ] is not included with the bid.

13. Bidder's Signature

The bidder hereby certifies that the information contained in these certifications and representations is accurate, complete, and current.

(Signature and Date)

(Typed or Printed Name)

(Title)

(Company Name)

(Company Address)

U.S. Department of Housing and Urban Development

Office of Public and Indian Housing

Instructions to Bidders for Contracts Public and Indian Housing Programs

Instructions to Bidders for Contracts

Public and Indian Housing Programs

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1. Bid Preparation and Submission

(a) Bidders are expected to examine the specifications, drawings, all instructions, and, if applicable, the construction site (see also the contract clause entitled **Site Investigation and Conditions Affecting the Work** of the *General Conditions of the Contract for Construction*). Failure to do so will be at the bidders' risk.

(b) All bids must be submitted on the forms provided by the Public Housing Agency/Indian Housing Authority (PHA/IHA). Bidders shall furnish all the information required by the solicitation. Bids must be signed and the bidder's name typed or printed on the bid sheet and each continuation sheet which requires the entry of information by the bidder. Erasures or other changes must be initialed by the person signing the bid. Bids signed by an agent shall be accompanied by evidence of that agent's authority. (Bidders should retain a copy of their bid for their records.)

(c) Bidders must submit as part of their bid a completed form HUD-5369-A, "Representations, Certifications, and Other Statements of Bidders."

(d) All bid documents shall be sealed in an envelope which shall be clearly marked with the words "Bid Documents," the Invitation for Bids (IFB) number, any project or other identifying number, the bidder's name, and the date and time for receipt of bids.

(e) If this solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "No Bid" in the space provided for any item on which no price is submitted.

(f) Unless expressly authorized elsewhere in this solicitation, alternate bids will not be considered.

(g) Unless expressly authorized elsewhere in this solicitation, bids submitted by telegraph or facsimile (fax) machines will not be considered.

(h) If the proposed contract is for a Mutual Help project (as described in 24 CFR Part 905, Subpart E) that involves Mutual Help contributions of work, material, or equipment, supplemental information regarding the bid advertisement is provided as an attachment to this solicitation.

2. Explanations and Interpretations to Prospective Bidders

(a) Any prospective bidder desiring an explanation or interpretation of the solicitation, specifications, drawings, etc., must request it at least 7 days before the scheduled time for bid opening. Requests may be oral or written. Oral requests must be confirmed in writing. The only oral clarifications that will be provided will be those clearly related to solicitation procedures, i.e., not substantive technical information. No other oral explanation or interpretation will be provided. Any information given a prospective bidder concerning this solicitation will be furnished promptly to all other prospective bidders as a written amendment to the solicitation, if that information is necessary in submitting bids, or if the lack of it would be prejudicial to other prospective bidders.

(b) Any information obtained by, or provided to, a bidder other than by formal amendment to the solicitation shall not constitute a change to the solicitation.

3. Amendments to Invitations for Bids

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date on the bid form, or (3) by letter, telegram, or facsimile, if those methods are authorized in the solicitation. The PHA/IHA must receive acknowledgement by the time and at the place specified for receipt of bids. Bids which fail to acknowledge the bidder's receipt of any amendment will result in the rejection of the bid if the amendment(s) contained information which substantively changed the PHA's/IHA's requirements.

(c) Amendments will be on file in the offices of the PHA/IHA and the Architect at least 7 days before bid opening.

4. Responsibility of Prospective Contractor

(a) The PHA/IHA will award contracts only to responsible prospective contractors who have the ability to perform successfully under the terms and conditions of the proposed contract. In determining the responsibility of a bidder, the PHA/IHA will consider such matters as the bidder's:

(1) Integrity;

(2) Compliance with public policy;

(3) Record of past performance; and

(4) Financial and technical resources (including construction and technical equipment).

(b) Before a bid is considered for award, the bidder may be requested by the PHA/IHA to submit a statement or other documentation regarding any of the items in paragraph (a) above. Failure by the bidder to provide such additional information shall render the bidder nonresponsible and ineligible for award.

5. Late Submissions, Modifications, and Withdrawal of Bids

(a) Any bid received at the place designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it:

(1) Was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th);

(2) Was sent by mail, or if authorized by the solicitation, was sent by telegram or via facsimile, and it is determined by the PHA/IHA that the late receipt was due solely to mishandling by the PHA/IHA after receipt at the PHA/IHA; or

(3) Was sent by U.S. Postal Service Express Mail Next Day Service - Post Office to Addressee, not later than 5:00 p.m. at the place of mailing two working days prior to the date specified for receipt of proposals. The term "working days" excludes weekends and observed holidays.

(b) Any modification or withdrawal of a bid is subject to the same conditions as in paragraph (a) of this provision.

(c) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date or the bid, modification, or withdrawal shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, bidders should request the postal clerk to place a hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

(d) The only acceptable evidence to establish the time of receipt at the PHA/IHA is the time/date stamp of PHA/IHA on the proposal wrapper or other documentary evidence of receipt maintained by the PHA/IHA.

(e) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent by Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and the postmark on both the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph (c) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and Failure by a bidder to acknowledge receipt of the envelope or wrapper.

(f) Notwithstanding paragraph (a) of this provision, a late modification of an otherwise successful bid that makes its terms more favorable to the PHA/IHA will be considered at any time it is received and may be accepted.

(g) Bids may be withdrawn by written notice, or if authorized by this solicitation, by telegram (including mailgram) or facsimile machine transmission received at any time before the exact time set for opening of bids; provided that written confirmation of telegraphic or facsimile withdrawals over the signature of the bidder is mailed and postmarked prior to the specified bid opening time. A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for opening of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

6. Bid Opening

All bids received by the date and time of receipt specified in the solicitation will be publicly opened and read. The time and place of opening will be as specified in the solicitation. Bidders and other interested persons may be present.

7. Service of Protest

(a) Definitions. As used in this provision:

"Interested party" means an actual or prospective bidder whose direct economic interest would be affected by the award of the contract.

"Protest" means a written objection by an interested party to this solicitation or to a proposed or actual award of a contract pursuant to this solicitation.

(b) Protests shall be served on the Contracting Officer by obtaining written and dated acknowledgement from —

[Contracting Officer designate the official or location where a protest may be served on the Contracting Officer]

(c) All protests shall be resolved in accordance with the PHA's/IHA's protest policy and procedures, copies of which are maintained at the PHA/IHA.

8. Contract Award

(a) The PHA/IHA will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the PHA/IHA considering only price and any price-related factors specified in the solicitation.

(b) If the apparent low bid received in response to this solicitation exceeds the PHA's/IHA's available funding for the proposed contract work, the PHA/IHA may either accept separately priced items (see 8(e) below) or use the following procedure to determine contract award. The PHA/IHA shall apply in turn to each bid (proceeding in order from the apparent low bid to the high bid) each of the separately priced bid deductible items, if any, in their priority order set forth in this solicitation. If upon the application of the first deductible item to all initial bids, a new low bid is within the PHA's/IHA's available funding, then award shall be made to that bidder. If no bid is within the available funding amount, then the PHA/IHA shall apply the second deductible item. The PHA/IHA shall continue this process until an evaluated low bid, if any, is within the PHA's/IHA's available funding. If upon the application of all deductibles, no bid is within the PHA's/IHA's available funding, or if the solicitation does not request separately priced deductibles, the PHA/IHA shall follow its written policy and procedures in making any award under this solicitation.

(c) In the case of tie low bids, award shall be made in accordance with the PHA's/IHA's written policy and procedures.

(d) The PHA/IHA may reject any and all bids, accept other than the lowest bid (e.g., the apparent low bid is unreasonably low), and waive informalities or minor irregularities in bids received, in accordance with the PHA's/IHA's written policy and procedures.

(e) Unless precluded elsewhere in the solicitation, the PHA/IHA may accept any item or combination of items bid.

(f) The PHA/IHA may reject any bid as nonresponsive if it is materially unbalanced as to the prices for the various items of work to be performed. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

(g) A written award shall be furnished to the successful bidder within the period for acceptance specified in the bid and shall result in a binding contract without further action by either party.

9. Bid Guarantee (applicable to construction and equipment contracts exceeding $25,000)

All bids must be accompanied by a negotiable bid guarantee which shall not be less than five percent (5%) of the amount of the bid. The bid guarantee may be a certified check, bank draft, U.S. Government Bonds at par value, or a bid bond secured by a surety company acceptable to the U.S. Government and authorized to do business in the state where the work is to be performed. In the case where the work under the contract will be performed on an Indian reservation area, the bid guarantee may also be an irrevocable Letter of Credit (see provision 10, Assurance of Completion, below). Certified checks and bank drafts must be made payable to the order of the PHA/IHA. The bid guarantee shall insure the execution of the contract and the furnishing of a method of assurance of completion by the successful bidder as required by the solicitation. Failure to submit a bid guarantee with the bid shall result in the rejection of the bid. Bid guarantees submitted by unsuccessful bidders will be returned as soon as practicable after bid opening.

10. Assurance of Completion

(a) Unless otherwise provided in State law, the successful bidder shall furnish an assurance of completion prior to the execution of any contract under this solicitation. This assurance may be [Contracting Officer check applicable items] —

[ ] (1) a performance and payment bond in a penal sum of 100 percent of the contract price; or, as may be required or permitted by State law;

[ ] (2) separate performance and payment bonds, each for 50 percent or more of the contract price;

[ ] (3) a 20 percent cash escrow;

[ ] (4) a 25 percent irrevocable letter of credit; or,

[ ] (5) an irrevocable letter of credit for 10 percent of the total contract price with a monitoring and disbursements agreement with the IHA (applicable only to contracts awarded by an IHA under the Indian Housing Program).

(b) Bonds must be obtained from guarantee or surety companies acceptable to the U.S. Government and authorized to do business in the state where the work is to be performed. Individual sureties will not be considered. U.S. Treasury Circular Number 570, published annually in the Federal Register, lists companies approved to act as sureties on bonds securing Government contracts, the maximum underwriting limits on each contract bonded, and the States in which the company is licensed to do business. Use of companies listed in this circular is mandatory. Copies of the circular may be downloaded on the U.S. Department of Treasury website **http://www.fms.treas.gov/c570/index.html**, or ordered for a minimum fee by contacting the Government Printing Office at (202) 512-2168.

(c) Each bond shall clearly state the rate of premium and the total amount of premium charged. The current power of attorney for the person who signs for the surety company must be attached to the bond. The effective date of the power of attorney shall not precede the date of the bond. The effective date of the bond shall be on or after the execution date of the contract.

(d) Failure by the successful bidder to obtain the required assurance of completion within the time specified, or within such extended period as the PHA/IHA may grant based upon reasons determined adequate by the PHA/IHA, shall render the bidder ineligible for award. The PHA/IHA may then either award the contract to the next lowest responsible bidder or solicit new bids. The PHA/IHA may retain the ineligible bidder's bid guarantee.

11. Preconstruction Conference (applicable to construction contracts)

After award of a contract under this solicitation and prior to the start of work, the successful bidder will be required to attend a preconstruction conference with representatives of the PHA/IHA and its architect/engineer, and other interested parties convened by the PHA/IHA. The conference will serve to acquaint the participants with the general plan of the construction operation and all other requirements of the contract (e.g., Equal Employment Opportunity, Labor Standards). The PHA/IHA will provide the successful bidder with the date, time, and place of the conference.

12. Indian Preference Requirements (applicable only if this solicitation is for a contract to be performed on a project for an Indian Housing Authority)

(a) HUD has determined that the contract awarded under this solicitation is subject to the requirements of section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e(b)). Section 7(b) requires that any contract or subcontract entered into for the benefit of Indians shall require that, to the greatest extent feasible

(1) Preferences and opportunities for training and employment (other than core crew positions; see paragraph (h) below) in connection with the administration of such contracts or subcontracts be given to qualified "Indians." The Act defines "Indians" to mean persons who are members of an Indian tribe and defines "Indian tribe" to mean any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians; and,

(2) Preference in the award of contracts or subcontracts in connection with the administration of contracts be given to Indian organizations and to Indian-owned economic enterprises, as defined in section 3 of the Indian Financing Act of 1974 (25 U.S.C. 1452). That Act defines "economic enterprise" to mean any Indian-owned commercial, industrial, or business activity established or organized for the purpose of profit, except that the Indian ownership must constitute not less than 51 percent of the enterprise; "Indian organization" to mean the governing body of any Indian tribe or entity established or recognized by such governing body; "Indian" to mean any person who is a member of any tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs and any "Native" as defined in the Alaska Native Claims Settlement Act; and Indian "tribe" to mean any Indian tribe, band, group, pueblo, or community including Native villages and Native groups (including

corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs.

(b) (1) The successful Contractor under this solicitation shall comply with the requirements of this provision in awarding all subcontracts under the contract and in providing training and employment opportunities.

(2) A finding by the IHA that the contractor, either (i) awarded a subcontract without using the procedure required by the IHA, (ii) falsely represented that subcontracts would be awarded to Indian enterprises or organizations; or, (iii) failed to comply with the contractor's employment and training preference bid statement shall be grounds for termination of the contract or for the assessment of penalties or other remedies.

(c) If specified elsewhere in this solicitation, the IHA may restrict the solicitation to qualified Indian-owned enterprises and Indian organizations. If two or more (or a greater number as specified elsewhere in the solicitation) qualified Indian-owned enterprises or organizations submit responsive bids, award shall be made to the qualified enterprise or organization with the lowest responsive bid. If fewer than the minimum required number of qualified Indian-owned enterprises or organizations submit responsive bids, the IHA shall reject all bids and readvertise the solicitation in accordance with paragraph (d) below.

(d) If the IHA prefers not to restrict the solicitation as described in paragraph (c) above, or if after having restricted a solicitation an insufficient number of qualified Indian enterprises or organizations submit bids, the IHA may advertise for bids from non-Indian as well as Indian-owned enterprises and Indian organizations. Award shall be made to the qualified Indian enterprise or organization with the lowest responsive bid if that bid is -

(1) Within the maximum HUD-approved budget amount established for the specific project or activity for which bids are being solicited; and

(2) No more than the percentage specified in 24 CFR 905.175(c) higher than the total bid price of the lowest responsive bid from any qualified bidder. If no responsive bid by a qualified Indian-owned economic enterprise or organization is within the stated range of the total bid price of the lowest responsive bid from any qualified enterprise, award shall be made to the bidder with the lowest bid.

(e) Bidders seeking to qualify for preference in contracting or subcontracting shall submit proof of Indian ownership with their bids. Proof of Indian ownership shall include but not be limited to:

(1) Certification by a tribe or other evidence that the bidder is an Indian. The IHA shall accept the certification of a tribe that an individual is a member.

(2) Evidence such as stock ownership, structure, management, control, financing and salary or profit sharing arrangements of the enterprise.

(f) (1) All bidders must submit with their bids a statement describing how they will provide Indian preference in the award of subcontracts. The specific requirements of that statement and the factors to used by the IHA in determining the statement's adequacy are included as an attachment to this solicitation. Any bid that fails to include the required statement shall be rejected as nonresponsive. The IHA may require that comparable statements be provided by subcontractors to the successful Contractor, and may require the Contractor to reject any bid or proposal by a subcontractor that fails to include the statement.

(2) Bidders and prospective subcontractors shall submit a certification (supported by credible evidence) to the IHA in any instance where the bidder or subcontractor believes it is infeasible to provide Indian preference in subcontracting. The acceptance or rejection by the IHA of the certification shall be final. Rejection shall disqualify the bid from further consideration.

(g) All bidders must submit with their bids a statement detailing their employment and training opportunities and their plans to provide preference to Indians in implementing the contract; and the number or percentage of Indians anticipated to be employed and trained. Comparable statements from all proposed subcontractors must be submitted. The criteria to be used by the IHA in determining the statement(s)'s adequacy are included as an attachment to this solicitation. Any bid that fails to include the required statement(s), or that includes a statement that does not meet minimum standards required by the IHA shall be rejected as nonresponsive.

(h) Core crew employees. A core crew employee is an individual who is a bona fide employee of the contractor at the time the bid is submitted; or an individual who was not employed by the bidder at the time the bid was submitted, but who is regularly employed by the bidder in a supervisory or other key skilled position when work is available. Bidders shall submit with their bids a list of all core crew employees.

(i) Preference in contracting, subcontracting, employment, and training shall apply not only on-site, on the reservation, or within the IHA's jurisdiction, but also to contracts with firms that operate outside these areas (e.g., employment in modular or manufactured housing construction facilities).

(j) Bidders should contact the IHA to determine if any additional local preference requirements are applicable to this solicitation.

(k) The IHA [ ] does [ ] does not [Contracting Officer check applicable box] maintain lists of Indian-owned economic enterprises and Indian organizations by specialty (e.g., plumbing, electrical, foundations), which are available to bidders to assist them in meeting their responsibility to provide preference in connection with the administration of contracts and subcontracts.

These conditions are a supplement to the HUD 5369 Instructions to Bidders and provide information to help clarify articles of that document. Any articles or paragraphs not specifically mentioned shall remain as printed in HUD 5369 without change.

1. Add to Paragraph 1, subparagraph b:

   i. The bid documents required for the complete bid package shall consist of the following (all shall be signed originals):

      1. Bid Form
      2. Bid Bond
      3. Non-Collusive Affidavit
      4. Disclosure of Lobbying Activities
      5. Form HUD-2530
      6. Form HUD-5369A

2. Add to paragraph 2 subparagraph a

   a. All questions are to be received in writing. Oral questions will not be accepted. Oral clarifications will not be provided.
   b. Responses to all written questions will be posted as addendum on the CMHA website at www.cintimha.com.

3. Add to paragraph 4 subparagraph b.1.

   b.1 Bidders shall indicate receipt of addendum on Bid Form. No other acknowledgement is required.

4. Add to paragraph 4, subparagraph a:

   a. Ability to demonstrate a minimum of 7 years of experience as a general contractor, performing work of like scope and material, for the period immediately preceding commencement of this CMHA Project for work of the size and type of this CMHA Project.

CMHA, in its sole and absolute discretion, will consider a request for a waiver of the 7 years of experience requirement, if the contractor can establish that it has successfully undertaken and completed such a number of projects of similar scope and complexity in a lesser number of years so as to confer upon that contractor the same or more experience as other bidders have achieved in 7 or more years of experience.

5. Add to paragraph 5, subparagraph g:

g. No bid shall be withdrawn for a time period of 330 calendar days from the bid opening. The foregoing limitation upon withdrawal of bids prior to opening shall be subject to the right of withdrawal of a bid made in error as provided by Section 9.31, Ohio Revised Code, to the extent that such statutory provision is applicable.

6. Add to paragraph 10, subparagraphs a, and b:

a. All bid bonds be a shall be issued by Surety Companies licensed to issue bonds in the State of Ohio and listed in Federal Register Circular #570. The current power of attorney for the person who signs for any surety company shall be attached to such bid bond.

b. The CMHA will have the right to retain the bid security of bidders to whom an award is being considered until either (a) the contract has been executed and bonds, if required, have been executed, (b) the specified time has elapsed so that bids may be withdrawn, or (c) all bids have been rejected.

7. Add paragraph 13. Minority Business Enterprise:

It is the goal of CMHA to obtain 20 percent minority business participation on this project.

8. Add paragraph 14. Lead Based Paint:

Any contractor awarded a contract for modernization shall comply with 24 CFR (Code of Federal Regulations) Part 35 prohibiting the use of lead-based paint.

9. Add paragraph 15. Sales Tax Exemption:

The contractor shall take whatever steps required by law to relieve the owner from payment of excise tax and Ohio sales tax on materials, specialties and equipment for contractor to take any part of such action shall constitute the responsibility of the contractor to make such tax payments as within the scope of this contract. The owner is tax exempt, and upon request will provide a statement to that effect.

10. Add paragraph 16. Liquidated Damages

This project has liquidated damages, as specified in Clause 33 of HUD General Conditions in this contract, which may be charged against contractors who do not complete work on time.

11. Add paragraph 17. Pre-Bid Conference

A pre-bid conference for all prospective contractors will be held as indicated on the Invitation of Bids. Questions will not be received or answered at the pre-bid conference. All questions are to be submitted in writing and responses will beposted as addendum to the CMHA website atwww.cintimha.com.

Before presenting a bid, the contractor is advised to have visited the site and be thoroughly familiar with the scope of work and the conditions under which it will be executed. Failure to do so will not release contractor of his obligation to furnish all material and labor necessary to carry out all provisions of the contract.

Add paragraph 18. Definition

Addenda are written or graphic instruments issued by the CMHA prior to the execution of the Contract, which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

A Bid is a complete and properly signed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be in Alternate Bids.

An Alternate Bid or Alternate is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted. Any alternates accepted by the owner shall be accepted in the order in which they are listed in the form of Bid.

A Unit Price is an amount stated in the Bid as a price per unit of measure for materials, equipment or services or a portion of the Work as described in the Bidding Documents, and to be utilized at CMHA's sole discretion.

12. Add paragraph 19. Form and Style of Bids

a. Bids shall be submitted on the form included in the Bidding Documents.

b. All blanks on the Bid Form shall be filled in by typewriter or manually in ink.

c. Where so indicated by the makeup of the Bid Form, sums shall be expressed in both words and figures, and in case of discrepancy between the two, the amount written in words shall govern.

d. The signer of the Bid must initial interlineations, alterations and erasures.

e. All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

f. Each copy of the Bid shall include the legal name of the Bidder and a statement that the Bidder is a sole proprietor, partnership, corporation or other legal entity. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

END OF SECTION

CONSTRUCTION CONTRACT

CINCINNATI METROPOLITAN HOUSING AUTHORITY
AND

_____

CONTRATOR

This Contract is made and entered into between the Cincinnati Metropolitan Housing Authority, hereinafter referred to as "Owner" and the below named, hereinafter referred to as "CONTRACTOR."

1. PURPOSE AND BACKGROUND

OWNER is the 17th largest public housing authority in the United States. OWNER's Asset Management Portfolio of properties are owned and operated by OWNER.

The purpose of this contract is for the Contractor to provide construction services at OWNER's property further described in *The Scope of Work*.

2. STATEMENT OF WORK

The Contractor shall furnish the personnel, material, and/or services and otherwise do all things necessary for or incidental to the performance of the work set forth in *the Scope of Work*

The General Terms and Conditions of the Construction Contract govern the work to be performed under this contract, the nature of the working relationship between OWNER and the Contractor, and specific obligations of both parties.

3. APPLICABLE DOCUMENTS

This contract includes all relevant terms in Solicitation 2024-3035, the Contractor's Fee Submission Form and all documents, policies, and documents incorporated by reference. All documents, sections, exhibits, clauses, terms and provisions of this Performance Based Contract shall be read so as to be consistent to all extent practicable. In the event that any document, section, clause, exhibit, term or provision of this Contract conflicts with any provision of any of the above-mentioned applicable document, the provision of the instruments listed below shall take precedence in the following order:

a) Applicable Federal and State of Ohio statutes and regulations
b) This Instrument (Performance Based Contract)
c) Solicitation
d) The Contractor's Fee
e) Other Documents incorporated by reference (if applicable)

SAMPLE

4. PERIOD OF PERFORMANCE

Subject to other Contract provisions, the period of performance under this Contract shall be from as indicated in the Notice to Proceed, unless sooner terminated or extended as provided herein.

Upon issuance of the Notice to Proceed by Owner, the Contractor shall have two (2) weeks from the issuance of the Notice to submit applications for any required permits. Contractor shall have one (1) week to begin work after receipt of the applicable permits. Failure to meet these deadlines shall constitute a material breach of the terms of this Agreement and shall constitute good cause for the Owner to cancel this contract.

5. COMPENSATION AND PAYMENT

Billing and payment shall be accomplished in accordance with the Contract. OWNER shall pay an amount not to exceed the Fee Amount on item 9 of the *Fee Submission Form*, as breakdown in the Schedule of Values approved by the OWNER, for the performance of all things necessary for, or incidental to the performance of work as set forth in *The Scope of Work*.

Payment shall be contingent upon review and acceptance of the Contractor's Deliverables by OWNER.

OWNER will pay Contractor within 45 days of receipt of properly completed invoices or acceptance of deliverable, whichever is later. Invoices shall be submitted to the Construction Manager or designated not more often than monthly. The invoice shall reference the Contract No., describe and document to OWNER's satisfaction as description of the deliverable accepted by OWNER and the fixed price cost per deliverable. OWNER may, in its sole discretion, withhold payments claimed by Contractor for services rendered if Contractor fails to satisfactorily comply with any term or condition of this Contract. Invoices shall be sent to 1627 Western Ave., Cincinnati, OH 45214

6. WARRANTIES

Contractor warrants that its services and materials provided will be of good quality and consistent with the professional skill and care ordinarily provided by professionals performing the same or similar service and such services and materials shall be provided in accordance with generally accepted industry standards.

At all times Contractor shall comply with all applicable federal, state and local laws, rules, regulations, ordinances and codes and obtain any licenses or permits required to provide the services under this Contract.

SAMPLE

7. EXECUTIVE REVIEW

This Contract shall be subject to the written approval of OWNER's authorized representative and shall not be binding until so approved.

IN WITNESS WHEREOF, this PROFESSIONAL SERVICES AGREEMENT has been

executed by OWNER and _____
to take effect on _____

_____	_____
Cincinnati Metropolitan Housing Authority	**Contractor**
Sign and Date	Sign and Date

SAMPLE

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1. ARTICLE I CONTRACTOR'S RESPONSIBILITIES

1.1. The Contractor shall perform the Work in a workmanlike manner, consistent with the standards of skill and care exercised by entities licensed to perform (where required by Applicable Law) and regularly performing comparable work in the same or similar locality under the same or similar circumstances.

1.1.1. Furthermore, Contractor agrees to adhere to CMHA's quality standards as outlined in the Contract Documents; this includes, but is not necessary limited to, CMHA's Gold Standards of performance.

1.2. The Contractor shall perform the Work in accordance with the Contract Documents.

1.3. The Contractor shall furnish all labor, services, materials, tools, equipment, superintendence, and transportation necessary for performance of the Work.

1.3.1. Contractor shall also furnish all necessary water, heat, light, and power not made available to the Contractor by CMHA.

1.4. The Contractor shall perform on the site and with its own organization, work equivalent to at least {12%} (unless otherwise indicated) of the total amount of work to be performed under the order.

1.4.1. This percentage may reduce by a supplemental agreement to this Construction Contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be the advantage of CMHA.

1.5. At all times during performance of this Construction Contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the work site a competent superintendent whose qualifications and experience are satisfactory to CMHA and has authority to act on behalf of the Contractor.

1.6. The Contractor shall be responsible for all damages, including, but not limited to, damages to persons or property, that occur as a result of the Contractor's breach of this Construction Contract, fault or negligence.

1.6.1. The Contractor shall take proper safety and health precautions to protect the Work, the workers, the public, and the property of others.

1.6.2. The Contractor shall hold and save CMHA, including CMHA's officers, employees, consultants, and agents, free and harmless from damages, claims, demands, suits and liabilities of any nature, including but not limited to, all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, caused by the Contractor's breach of this Construction Contract, fault, negligence or performance of the Work.

1.6.3. The Contractor shall also be responsible for all storage, protection and cleaning of materials delivered and Work performed on the Project, until Contract Completion and acceptance of the entire Project by CMHA, except for any completed unit of Work which may have not been accepted under the Construction Contract.

1.7. The Contractor shall lay out the work from base lines and bench marks indicated in the drawings and be responsible for all lines, levels, and measurements of all work executed under the Contract Documents.

1.7.1. The Contractor shall verify the lines, bench marks, figures and dimensions indicated in the Contract Documents before laying out the work and will be held responsible for any resulting errors resulting from its failure to do so.

1.8. The Contractor shall confine all operations (including storage of materials) on CMHA's premises to areas authorized or approved by the Contracting Officer.

1.9. The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials.

1.9.1. After completing the Work and before final inspection, the Contractor shall:

- **A.** Remove from the premises all scaffolding, equipment, tools, materials (including rejected materials) that are not the property of CMHA and rubbish caused by its work;
- **B.** Leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer;
- **C.** Perform all specified tests; and
- **D.** Deliver the installation in complete and operating conditions.

1.10. The Contractor must perform the Work so as to not interfere with, disturb, hinder, or delay the services of separate consultants or the work of separate contractors.

1.10.1. The Contractor must cooperate and coordinate fully with all separate consultants and separate contractors and must freely share all of the Contractor's Project-related information with them to facilitate the timely and proper performance of the Work and of the services and work of the separate consultants and separate contractors.

1.10.2. The Contractor must afford every separate consultant and separate Contractor proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of their services and work.

1.10.3. If the Contractor damages the property or work of any separate consultant or separate Contractor caused by Contractor or by failure to perform the Work with due diligence, delays, interferes with, hinders, or disrupts the services of any separate consultant or separate Contractor who suffers additional expense and damage as a result, the Contractor is responsible for that damage, injury, or expense.

1.10.4. The intent of 1.10 is to benefit any separate consultants and separate contractors and to demonstrate that the separate consultants or separate contractors are intended third-party beneficiaries of Contractor's obligations under the Contract.

1.11. If the proper execution or result of any part of the Work depends upon work performed or services provided by CMHA, a separate consultant, or a separate Contractor, the Contractor must inspect that other work and appropriate instruments of service, and promptly report to CMHA in writing any defects or deficiencies in that other work or services that render it unavailable or unsuitable for the proper execution and results of the Work.

1.11.1. The Contractor's failure to inspect and promptly report any issues in writing will constitute an acceptance of the other work and services as fit and proper for integration with the Contractor's Work unless in the opinion of CMHA's Project Manager and/or Construction Contract Administrator the defects and deficiencies in the other work and appropriate instruments of service were not reasonably discoverable at the time of the Contractor's inspection.

1.12. The Contractor shall not delay the Work on account of any claim, dispute, or action between the Contractor and CMHA or the Contractor a Separate Consultant or Separate Contractor.

1.13. The Contractor shall complete all portions of Work in the sequence in the Construction Progress Schedule.

1.14. The Contractor shall develop and keep a Construction Progress Schedule and prepare and keep current a schedule of submittals that is coordinated with the Construction Progress Schedule for CMHA's acceptance.

1.15. The Project's regular work hours shall be between 8:00 am and 5:00 pm, or as determined and approved by CMHA.

1.15.1. The Contractor may modify the regular work hours only if Contractor receives written authorization from CMHA's Project Manager and/or Construction Contract Administrator.

1.16. The Contractor shall coordinate the Work with the activities and responsibilities of the Project's architect or engineer ("A/E"), CMHA and Contractor's surety to meet the contractual dates for Substantial Completion and Contract Completion.

1.17. The Contractor shall remove any snow and ice as may be required for reasonably safe access to the Project, including, without limitation, building entries, driveways, parking lots, and sidewalks.

1.18. The Contractor shall keep a daily log containing a record of weather, number of workers on Site for the Contractor, identification of equipment, Work accomplished, problems encountered and other similar relevant data.

1.19. The Contractor hereby represents and agrees that, prior to submitting its bid or quote to perform the Work on the Project, it has had a competent person carefully and diligently review each part of the Contract Documents, including the Divisions of the Specifications and parts of the Drawings that are not directly applicable to the Work.

1.19.1. Contractor further represents and agrees that, based upon its careful and diligent review of the Contract Documents, that it is not aware of any conflicts, inconsistencies, errors, or omissions in the Contract Documents for which it has not notified CMHA or the A/E.

1.19.2. If there are any such conflicts, inconsistencies, errors, or omissions in the Contract Documents, the Contractor will:

A. Provide the labor, equipment, or materials of the better quality or greater quantity of Work; and/or

B. Comply with the more stringent requirements.

1.19.3. The Contractor will not be entitled to any additional compensation for any conflicts, inconsistencies, errors, or omissions that would have been discovered by such careful and diligent review.

1.20. The Contractor hereby represents and agrees that the Project is a public project involving public funds.

1.20.1. The Contractor further understands that CMHA expects and requires that each Contractor adhere to the highest ethical and performance standards.

1.20.2. Accordingly, Contractor hereby pledges and agrees that:

A. It will act at all times with absolute integrity and truthfulness in its dealings with CMHA and the A/E;

B. It will use its best efforts to cooperate with CMHA and the A/E and all other contractors and consultants on the Project and at all times will act with professionalism and dignity in its dealings with CMHA, the A/E, and other contractors;

C. It will assign only competent supervisors and workers to the Project, each of whom is fully qualified to perform the tasks that are assigned to him/her; and

D. It has read, understands and will comply with the terms of the Contract Documents.

1.21. Emergency

1.21.1. In the event of an emergency affecting the safety of the Project, other property, or individuals, the Contractor, without special instructions or authorization, shall act to prevent the threatened damage, injury, or loss.

1.21.2. If the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of its actions in response to any emergency, the Contractor may request a Change Order by giving written notice no later than 48-hours after the emergency.

2. ARTICLE II HOUSING AUTHORITY RIGHTS AND RESPONSIBILITIES

2.1. CMHA shall designate a Project Manager and/or Construction Contract Administrator for the Project.

2.2. CMHA shall have access to the Work and Site at all times, whether the Project is in preparation or progress.

2.3. CMHA is not responsible for construction means, methods, manners, techniques, sequences, procedures, or for safety precautions and programs in connection with the Work, or for the Contractor's failure to carry out the Work in conformity with the Contract Documents.

2.4. Upon the date indicated in the Notice to Proceed, CMHA shall provide the Site to the Contractor in a condition to permit the Contractor to perform the Work.

2.4.1. If the Site provided by CMHA is not in a condition to permit the Contractor to perform the Work, Contractor shall notify CMHA's Project Manager and/or Construction Contract Administrator within 48 hours of the Notice to Proceed and identify the conditions which are preventing Contractor from performing the Work.

3. ARTICLE III A/E'S DUTY, RESPONSIBILITY AND AUTHORITY

3.1. The A/E for this Contract and any successor shall be designated in writing by CMHA.

3.2. The A/E's duties and responsibilities may include, but shall not be limited to:

3.2.1. Attend and conduct the Construction Progress Meetings.

3.2.2. Making periodic visits to the work site and on the basis of his/her on-site inspections, issuing written reports to CMHA which shall include all observed deficiencies.

A. The A/E shall electronically send a copy of the report to CMHA and to the Contractor's designated representative at the site.

3.2.3. Making modifications in drawings and technical specifications and assisting the Contracting Officer in the preparation of Change Orders and other Contract Modifications for issuance to the Contracting Officer.

3.2.4. The A/E may authorize minor changes or alterations in the Work that are consistent with the intent of the Contract Documents and do not involve adjustment of the Contract Sum or Contract Times, or both.

A. The A/E has no authority to authorize the Contractor to perform additional or extra Work for which the Contractor may seek adjustment of the Contract Sum or the Contract Time, or both.

3.2.5. Reviewing and making recommendations with respect to:

A. The Contractor's Construction Progress Schedules;

B. The Contractor's shop and detailed drawings; and

C. The Contractor's price breakdown and progress payment estimates.

3.2.6. Assisting in inspections, signing Certificates of Substantial Completion and Contract Completion, and making recommendations with respect to acceptance of work completed under the Contract; and

3.2.7. Approve or certify applicable forms required under the Contract Documents.

3.3. Site Visits and Observation

3.3.1. The A/E shall notify, advise, and consult with CMHA and protect CMHA against Defective Work throughout completion of the Project, which includes the Correction Period, and for such time period CMHA may extend A/E's services.

A. The A/E should designate a field representative, subject to CMHA's approval, to attend meetings, to observe and check the progress and quality of the Work, and to take action as necessary or appropriate to achieve conformity with the Contract Documents.

B. The A/E shall have its consultants attend to the Project at intervals required by its agreement or required by CMHA.

3.3.2. The A/E is authorized to disapprove or reject Defective Work. The A/E shall immediately notify CMHA any time the A/E disapproves or rejects an item of Work.

3.3.3. The A/E is not responsible for construction means, methods, manners, techniques, sequences, procedures, or for work safety precautions and programs in connection with the Work, or for the Contractor's failure to carry out the Work in conformity with the Contract Documents.

3.4. Testing and Inspection Services

3.4.1. Unless otherwise specified in the Contract Documents, CMHA shall apply for, secure, and pay for the costs of structural testing and special inspections under the Ohio Building Code; testing including geotechnical analysis, environmental testing and analysis, concrete, masonry, structural steel, reinforcing steel, welding, bolts, steel connections, HVAC systems and controls, plumbing and piping, air, and water balancing and testing, or other testing, or approvals required by Applicable Law.

3.5. A/E Review and Approval of Work

3.5.1. Any information the Contractor submits to the A/E is for the sole purpose of determining whether the Work and information is generally consistent with the Contract's intent, and will not relieve the Contractor of its sole responsibility for the performance, preparation, completeness, and accuracy of the Work and information.

3.5.2. By reviewing information submitted by the Contractor, A/E is not taking on responsibility for construction means, methods, manners, techniques, sequences, procedures, or for work safety precautions and programs in connection with the Work.

3.6. Limitation of A/E's Authority

3.6.1. The A/E shall serve as the technical representative for CMHA with respect to architectural, engineering, and design matters related to the Work performed under the Contract.

3.6.2. Subject to the Contractor's responsibility under ARTICLE I, the A/E may provide direction on Contract performance.

3.6.3. Such direction shall be within the scope of the Contract and may not be of a nature which:

A. Institutes additional work outside of the scope of the Contract;

B. Constitutes a change;

C. Causes an increase or decrease in the cost of the Contract;

D. Alters the Construction Progress Schedule;

E. Changes any of the other express terms or conditions of the Contract;

F. Accepts any defective or non-conforming services, Work, or vendor-furnished items;

G. Makes any settlements on CMHA's behalf;

H. Assumes any responsibilities of the Contractor or Subcontractors; or

I. Binds CMHA to any authorizations under, modifications of, or amendments to the Contract Documents other than as expressly provided A/E'S DUTY, RESPONSIBILITY AND AUTHORITY.

3.7. The Contractor acknowledges and agrees that CMHA's legal counsel may from time to time provide legal services to the Project and that in doing so may communicate with the A/E, as CMHA's representative on the Project.

3.7.1. The Contractor agrees that such communications will be privileged communications and, if there is a Claim contemplated or pending, any written communications will be protected by the attorney client privilege and considered confidential work product.

4. ARTICLE IV PRECONSTRUCTION ACTIVITIES

4.1. Pre-construction Conference

4.1.1. Within ten (10) calendar days, unless otherwise indicated by CMHA, of Contract execution, and prior to the commencement of work, the Contractor shall attend a preconstruction conference with CMHA representatives; CMHA's A/E, and other interested parties convened by CMHA.

A. The conference will serve to acquaint the participants with the general plan of the construction operation and all other requirements of the Contract.

B. CMHA will provide the Contractor with the date, time, and place of the conference.

4.2. Certificate of Insurance

4.2.1. Before commencing work, the Contractor and each Subcontractor shall furnish CMHA with certificates of insurance showing the minimum insurance coverage is in force and will insure all operations under the Contract.

4.3. Building and Trade Permits, Licenses and Codes

4.3.1. The Contractor shall give all notices and comply with all applicable laws, ordinances, codes, rules, and regulations.

A. Notwithstanding the requirement of the Contractor to comply with the drawings and specifications in the Contract, all Work installed shall comply with all applicable laws, ordinances, codes, rules, and regulations, as may be amended by any waivers.

B. Before installing the Work, the Contractor shall examine all drawings and the specifications for compliance with applicable laws, ordinances, codes, rules, and regulations bearing on the work and shall immediately report, in writing, any discrepancy it may discover to the CMHA's Project Manager and/or Construction Contract Administrator and the A/E.

i. If required by any governing jurisdiction, CMHA will modify the Contract by change order so that the Work on the Project will conform to the applicable laws, ordinances, codes, rules, and regulations.

C. If the Contractor installs any Work that does not comply with all applicable laws, ordinances, codes, rules, and regulations before providing notice hereunder to CMHA and receiving direction from CMHA, Contractor shall be responsible for all costs resulting from any removal, demolishing, and disposing of any Work that must be replaced or repaired.

4.3.2. Notwithstanding the provisions below, the Contractor shall secure and pay for all permits, fees, and licenses necessary for the proper execution and completion of Work.

A. Where CMHA can arrange for the issuance of all or part of these permits, fees, and licenses, without cost to the Contractor, the Contract amount shall be reduced accordingly.

4.4. Plan Approval and Permits

4.4.1. The A/E shall facilitate the required structural, plumbing, HVAC, and electrical plan reviews during the design phase, as required by the governing jurisdiction for securing an overall building permit to start construction.

4.4.2. The Contractor shall schedule and attend all intermediate and final inspections required for any permit applicable to the Work or any governing jurisdiction.

4.4.3. The Contractor shall schedule with the State Fire Marshal or local fire authority for the life safety inspection for occupancy permits.

4.4.4. The Contractor shall give the A/E and CMHA reasonable notice of the dates and times for any inspections.

A. The Contractor shall pay for all initial inspections and re-inspections required as a result of Contractor's failure to receive approval for its Work.

4.5. Trade Permits and Licenses

4.5.1. The Contractor shall secure and pay the fees for any permit, inspection, or license applicable to the Contractor's particular trade.

4.5.2. Local Permits:

A. The Contractor shall secure and pay the fees for any permits, inspections, licenses, capacity charges, or tap fees required by local authorities having jurisdiction over the Project.

i. The Contractor shall give the A/E and CMHA reasonable notice of the date(s) arranged for inspections.

4.5.3. National Pollutant Discharge Elimination System (NPDES) Storm Water General Permit:

A. The A/E shall secure the NPDES general permit by submitting a Notice of Intent (NOI) application form to the Ohio Environmental Protection Agency at least 45 days prior to the start of construction.

i. The Contractor shall be a co-permitee, if required under Applicable Law.

B. The A/E shall prepare and certify the storm water pollution prevention plan to provide sedimentation and erosion controls at the Project. The A/E shall prepare and process the required Notice of Termination (NOT) prior to Contract Completion.

5. ARTICLE V CONSTRUCTION REQUIREMENTS

5.1. Commencement of Work on Site

5.1.1. Unless CMHA agrees otherwise in writing, the Construction Stage will commence with CMHA issuing the Notice to Proceed and will terminate upon CMHA issuing a Certificate of Contract Completion to the Contractor. The Certificate of Contract Completion will be issued in accordance with the requirements of the Contract Documents and will not occur until after CMHA issues a Certificate of Substantial Completion, a Certificate of Occupancy is issued for the Project, and the Contractor has completed all items on the punch list delivered to Contractor by CMHA as provided in Article IX. The time period for Contract Completion in provided in Section 9.8.

5.1.2. Notice to Proceed:

A. The Contractor shall begin work upon the date indicated in a written Notice to Proceed from CMHA or its designee.

i. The Contractor shall not begin work prior to receiving such notice.

B. Typically, the Notice to Proceed shall be issued within 180 days of CMHA Board of Commissioner Approval.

C. If the Notice to Proceed is not issued with 180 days of CMHA Board of Commissioner Approval, CMHA may, in its sole discretion, terminate the Contract without recourse from the Contractor.

5.2. Environmental Controls

5.2.1. The Contractor shall protect its Work and materials from damage from water, moisture, and other weather, including damage from water run-off from other property or structures, and damage from heat, cold, and humidity.

5.2.2. Contractor is not authorized to use permanent HVAC system without express written authorization from CMHA.

5.2.3. Until the permanent HVAC system is complete and available for use:

A. The Contractor shall make arrangements and pay for installation and maintenance of temporary heating, cooling and ventilating systems; and

B. The Contractor shall pay the costs incurred in operating the temporary heating, cooling and ventilating systems.

5.2.4. When the permanent HVAC system is complete and available for use:

A. The Contractor shall start up and maintain operation of the permanent HVAC system, including filters, and promptly remove temporary heating, cooling and ventilating systems.

B. If the Project consists entirely of new construction, the Contractor shall pay the costs of energy consumed in operating the permanent HVAC system until Substantial Completion.

5.2.5. From the date of Substantial Completion, CMHA shall pay the cost of operating the permanent HVAC system for the occupied portion of the Project.

5.2.6. Use of the permanent HVAC system during construction shall not change, modify or reduce the Contractor's warranty and service obligations under the Contract Documents.

5.3. Construction Procedures

5.3.1. The Contractor is solely responsible for and has control over all construction means, methods, techniques, sequences, and procedures, for safety precautions and programs in connection with the Work, and for coordinating all portions of the Work.

5.3.2. If the Contract Documents give instructions that affect construction means, methods, manners, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety of them and, except as expressly stated herein, be fully and solely responsible for the jobsite safety of the means, manners, methods, techniques, sequences, or procedures.

5.3.3. If the Contractor determines that the means, methods, manners, techniques, sequences, or procedures specified in the Contract Documents may not be safe, the Contractor shall give timely written notice to CMHA.

A. The Contractor shall not proceed with that portion of the Work without further written instructions from CMHA.

5.3.4. Additional Contractor Responsibilities:

A. The Contractor shall lay out and coordinate all lines, levels, elevations, and measurements for all of the Work, coordinate and verify existing conditions, and notify the A/E and CMHA of discrepancies and conflicts before proceeding with installation or excavation.

B. The Contractor shall perform all cutting, fitting, or patching required for the Work and shall not endanger the Project by cutting, excavating, or otherwise altering the Project or any part of it.

C. If the Design requires sleeves for completing the specified Work, the Contractor and all Subcontractors shall coordinate to furnish and install the sleeves.

i. The Contractors are responsible for the exact location of and size of all holes and openings required to be formed or built for the Work.

D. The Contractor's patching shall match and blend with the existing adjacent surfaces.

E. In addition to the items herein, The Contractor is responsible for all items in REF _Ref449941734 \h CONTRACTOR'S RESPONSIBILITIES.

5.4. Utilities

5.4.1. Availability and Use of Utilities

A. If CMHA has existing access to utilities, CMHA shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and service as specified herein so long as the utility use does not interfere with CMHA's operations.

i. Unless otherwise provided in the Contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to CMHA or where the utility is produced by CMHA, at reasonable rates as determined by CMHA.

ii. The Contractor shall carefully conserve any utilities furnished by CMHA without charge.

B. The Contractor, at its expense and in a manner satisfactory to CMHA, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges.

i. Before final acceptance of the Work by CMHA, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

5.4.2. The Contractor shall comply with the requirement of the Ohio Revised Code, including ORC.

A. In addition, before starting excavation or trenching, the Contractor shall determine the location of any underground utilities and notify any public authority or utility having jurisdiction over the Project and secure any required approval.

5.4.3. The Contractor shall give CMHA at least two (2) business days advance notice of excavation of underground utilities registered with the Ohio Underground Utility Protection Services ("OUPS") and underground utilities shown on the drawings and Specifications who are not registered member of OUPS.

A. The Owner of an underground utility is required within 48 hours' notice to stake, mark, or otherwise designate the location for its utilities in the construction area together with its approximate depth.

B. In the event that any underground utility owner fails to timely perform, the Contractor shall notify the A/E and contact CMHA regarding the failure of the underground utility to timely perform its work.

5.4.4. Water and Drainage

A. The Contractor shall provide water necessary for the Work until the permanent plumbing system is available for use.

B. The Contractor shall provide all temporary drainage and all dewatering necessary for the Work and shall employ pumps, trenches, drains, sumps, and any other equipment necessary or required to provide satisfactory working conditions for the protection, execution, and completion of the Project. The Contractor shall be responsible for determining the specific means and methods to be used for dewatering.

C. The Contractor shall make arrangements and pay for installation and maintenance of temporary plumbing systems until the permanent plumbing system is available for use.

D. When the permanent plumbing system is complete and available for use:

i. The Contractor shall start up and maintain operation of the permanent plumbing systems, and make arrangements and pay for removal of temporary plumbing systems.

ii. If the Project consists entirely of new construction, the Contractor shall pay the costs of water consumed and sewage charges until Substantial Completion.

iii. If the Project is a renovation of an existing building or structure, addition(s) to an existing building or structure, or any combination of new construction and renovation work that does not allow separate metering of utilities, CMHA shall pay the costs of water consumed and sewage charges.

(a) If separate metering of utilities is available, the Contractor and CMHA will pay the costs of their respective use.

E. After the date of Substantial Completion, CMHA shall pay the costs of water consumed and sewage charges for the occupied portion of the Project.

F. Use of the permanent plumbing system during construction shall not change, modify, or reduce the Contractor's warranty and service obligations under the Contract Documents.

5.4.5. Electric Service

A. The Contractor shall provide temporary light and power; pay the charges for temporary electric service, installation, and removal if required.

B. If the Project consists entirely of new construction, the Contractor shall pay the cost of energy consumed until Substantial Completion.

C. If the Project is a renovation of an existing building or structure, addition(s) to an existing building or structure, or any combination of new construction and renovation work that does not allow separate metering of utilities, CMHA shall pay the cost of energy consumed.

i. If separate metering of utilities is available, the Contractor and CMHA will pay the costs of their respective use.

D. From the date of Substantial Completion, CMHA shall pay the cost of energy consumed for the occupied portions of the Project.

E. Use of the permanent electrical system during construction shall not change, modify, or reduce the Contractor's warranty and services obligations under the Contract Documents.

5.4.6. Payment of Utility Services

A. Unless otherwise expressly stated in the Contract Documents, Contractor shall reimburse CMHA the cost of utility services during the Construction Period.

B. Unless otherwise expressly stated in the Contract Documents, payment for reimbursement of CMHA for the cost of utility services during the Contract Period shall be made directly to CMHA.

i. If payment is not received, CMHA may deduct the cost of utility services from payments otherwise due to the Contractor.

ii. If the payments otherwise due to the Contractor are not sufficient to fully reimburse CMHA, either Contractor or its surety shall make whatever payments are necessary to fully reimburse CMHA.

C. Process for Payment:

i. Reimbursement from the Contactor shall be performed on a quarterly basis unless a more frequent payment schedule is agreed upon between CMHA and the contractor prior to start of the project.

5.4.7. Hoisting Facilities

A. The Contractor shall erect and maintain any hoisting equipment required for its Work.

B. If the electric service requirements of hoisting facilities differ from that available at the Site, the Contractor shall provide and pay for all necessary connections.

C. If a permanent elevator is identified in the Contract Documents to be used for hoisting materials or personnel during construction, the Contractor shall furnish an extended warranty and service contract in effect until the expiration of the Correction Period.

5.4.8. Interruption of Existing Services

A. Whenever it becomes necessary to interrupt existing services in use by CMHA or its tenants, including, but not limited to, sewer, water, gas, steam lines, electric, telephone, and cable service, the Contractor shall continue the associated Work on a non-stop 24-hour per day basis until that Work is completed and the service restored, or perform the associated Work at an alternate time as required by and in coordination with CMHA.

B. Before beginning that Work, the Contractor shall apply in writing to, and receive approval in writing from CMHA to establish a time when interruption of the service will cause a minimum of interference with the activities of CMHA and its tenants.

5.5. Construction Supervision

5.5.1. Unless waived by CMHA in writing, the Contractor shall provide continuous supervision at the Site through a competent project manager or superintendent when any Work is being performed.

A. The Contractor's project manager or superintendent shall not be involved with any work for Contractor other than the Project.

5.5.2. The Contractor's project manager and superintendent shall each have responsibility and authority to act on behalf of the Contractor.

A. All communication to the Contractor's project manager and superintendent shall be binding as if given directly by the Contractor.

5.5.3. The Contractor shall submit an outline of the qualifications and experience of the Contractor's proposed project manager and superintendent, including references, to CMHA no later than two (2) business days after request from CMHA.

A. For all Subcontracts in excess of $200,000 and for all other Subcontracts requested by CMHA, the Contractor shall submit an outline of the qualifications and experience of the Subcontractor's proposed project manager and proposed superintendent, including references, to CMHA no later than two (2) business days after CMHA's request.

B. CMHA may reject the Contractor or Subcontractor's proposed project manager and/or proposed superintendent.

i. If CMHA does not notify the Contractor of the rejection within thirty (30) calendar days after receiving the required information, it shall then indicate that CMHA does not have an objection, but does not affect CMHA's rights under the Contract Documents or any other provision relative to the project manager or superintendent.

C. If CMHA rejects the Contractor or Subcontractor's proposed project manager or proposed superintendent, the Contractor shall replace, or cause the Subcontractor to replace the project manager or superintendent (as appropriate) with someone acceptable to CMHA at no additional cost.

5.5.4. If CMHA does not object the proposed project manager or superintendent, the Contractor and its Subcontractor shall not replace their respective project managers and superintendents without prior written approval of CMHA.

5.6. Construction Progress Schedule

5.6.1. The Contractor shall, no later than seven (7) calendar days of the issuance of the Notice to Proceed or another period of time determined by the CMHA, prepare and submit to CMHA for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the Work, the dates on which the Contractor contemplates starting and completing the several salient features of the Work (including acquiring labor, materials, and equipment).

A. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period.

i. The Chart must be in a Critical Path Method (CPM) format.

B. If the Contractor fails to submit a schedule, that is acceptable to CMHA, within the time prescribed, CMHA may withhold approval of progress payments or take other remedies under the Contract until Contractor submits the required schedule that is acceptable to CMHA.

5.6.2. The Contractor shall monitor the Work for conformance with the Construction Progress Schedule and shall initiate revisions as required herein.

5.6.3. The Contractor shall enter the actual progress on the Construction Progress Schedule as required by CMHA, and after each update, Contractor shall immediately deliver three copies of the annotated Construction Progress Schedule to CMHA.

A. If CMHA determines, upon the basis of inspection conducted, herein that the Contractor is not meeting the approved Construction Progress Schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by CMHA, without additional cost to CMHA.

B. If the Contractor is not meeting the approved Construction Progress Schedule, CMHA may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as CMHA deems necessary to demonstrate how the approved rate of progress will be regained.

5.6.4. Failure of the Contractor to comply with the requirements of CMHA shall be grounds for a determination by CMHA that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the Contract.

A. Upon making this determination, CMHA may terminate the Contractor's right to proceed with the work, or any separable part of it.

5.6.5. Unless otherwise agreed to in writing, the Contractor shall develop the Construction Progress Schedule using commercially available, personal computer software acceptable to CMHA and shall submit all baseline and updated schedules to CMHA in the schedule's native format.

A. This submission shall be in both electronic and paper format.

5.6.6. The Construction Progress Schedule shall not exceed the time limits under the Contract Documents, shall provide for reasonable, efficient, and economical execution of the Project and shall relate to the entire project to the extent required by the Contract Documents.

A. In the event that a Construction Progress Schedule submitted by Contractor shows a completion date that extends beyond the Contract Time permitted to Contractor in the Contract Documents, such Construction Progress Schedule shall not be deemed to modify the Contract Time permitted in the Contract Documents. The Contract Time can only be changed by a properly executed Change Order.

5.6.7. The Contractor shall use the Construction Progress Schedule to plan, organize, and execute the Project, record and report actual performance and progress, and show how it plans to coordinate and complete all remaining work by Contract Completion within applicable Milestones.

A. The Project participants shall use the Construction Progress Schedule as a tool for scheduling and reporting sequences and/or the progress of the Work.

B. The Contractor shall provide a clear graphics legend and other data including without limitation Milestone dates, constraints, and other items required by the Project and CMHA.

C. Each submission shall show CMHA's Project number and Project name, and provide a signature approval and date line for the Contractor.

5.6.8. The Contractor shall provide the following in each Construction Progress Schedule:

A. Activity identification and description of each activity broken down to a maximum duration that is appropriate for the activity;

B. Contractor or Subcontractor performing each task;

C. Contractor's resources and crew size for each activity; and

D. Provide early start, early finish, late start, late finish dates.

5.6.9. Each Construction Progress Schedule shall show predecessor activities and successor activities for each activity, entry free float, total float and percentage of completion, and identify the appropriate predecessors and successors for all related activities.

5.6.10. The Construction Progress Schedule shall show all submittal dates, review and approval durations for coordination drawings, Shop Drawings, other action submittals and mock-up Work.

5.6.11. The Contractor shall submit the initial and all updates of the Construction Progress Schedule in graphic and tabular form to CMHA.

A. With each monthly Construction Progress Schedule update, the Contractor shall include a list of all changes to the previously approved baseline schedule or monthly updated schedule.

5.6.12. The Construction Progress Schedule shall be managed using early start dates and early finish dates.

A. The Contractor must exhaust all existing float before claiming additional time for a Change Order.

5.6.13. The Contractor's failure to submit and properly maintain an approved Construction Progress Schedule may result in withholding payment in accordance with the Contract Documents.

5.6.14. For each Progress Meeting, the Contractor shall provide a 2-6 week look-ahead schedule, as appropriate for the Project.

5.6.15. On a monthly basis, the Contractor shall prepare and submit to CMHA a written report describing:

A. Activities begun or finished during the preceding month;

B. Activities in progress and expected completion;

C. Activities to be started or finished in upcoming month including, without limitation, the Contractor's workforce size and total resource hours associated with those activities;

D. Recommendations for adjusting the Construction Progress Schedule to meet Milestone dates, the Substantial Completion date and the Contract Completion date; and

E. Other information requested by CMHA.

5.6.16. If it is apparent that the Contractor may be unable to meet Critical Path activities, Milestone completion dates, the Substantial Completion date(s) or the Contract Completion date, CMHA shall direct the Contractor to submit within three (3) business days a Recovery Plan to avoid or minimize a delay in the Project.

5.6.17. A Recovery Plan shall include, without limitation, adjustments to one or more of the following:

A. Workforce

B. Hours per shift

C. Shifts per workday

D. Workdays per week

E. Equipment

F. Activity logic

5.6.18. If CMHA approves the Recovery Plan, the Contractor shall prepare a revised Construction Progress Schedule within three (3) business days to CMHA.

A. If CMHA rejects the Recovery Plan, the Contractor shall submit, within three (3) days of CMHA's rejection, an alternate Recovery Plan to CMHA in writing for review and in accordance the Contract Documents.

5.6.19. The Contractor shall update the Construction Progress Schedule on a monthly basis, or other interval as approved by CMHA, in accordance with the Contract Documents.

A. The Contractor shall submit a tabular copy showing all changes to the previously approved schedule including, without limitation, logic, float, and actual start date of activities.

i. The original or initially approved Construction Progress Schedule and all subsequent Construction Progress Schedules submitted by the Contractor, and accepted by CMHA, shall serve as an affirmation that the Contractor agrees to meet the applicable requirements and updated Construction Progress Schedule.

B. The Contractor's failure to timely submit updated Construction Progress Schedules as deemed necessary by CMHA may result in withholding payments in.

5.7. Progress Meetings

5.7.1. Unless otherwise indicated in writing, CMHA shall schedule weekly Progress Meetings for the Contractor and other persons involved in the Project as deemed necessary for coordination of the Work by CMHA, including Contractor's Subcontractors on the Project.

A. The purpose of the Progress Meeting is to review progress on the Project during the previous week, discuss anticipated progress during the following weeks, review critical operations, and discuss critical problems.

5.7.2. The Contractor shall be represented at every Progress Meeting by a person authorized with signatory authority to make decisions regarding possible modifications of the Contract Documents or Construction Progress Schedule.

A. CMHA shall notify the Contractor and other persons involved in the Project of the time and place of the Progress Meeting that shall thereafter be the same day and hour of the week for the duration of the Project, unless CMHA notifies the Contractor and other Persons involved in the Project of a different day and hour at least two (2) business days in advance.

B. The Contractor shall have any of its Subcontractors attend the Progress Meeting as determined by the Contractor, or as requested by CMHA.

C. Unless otherwise indicated in writing, CMHA shall prepare a written report of each Progress Meeting and distribute the report to the A/E and the Contractor.

D. If any person in attendance objects to anything in a report of a Progress Meeting, the person shall notify CMHA and any other affected person in writing explaining the objections within seven (7) calendar days of receipt of the Progress Meeting report.

E. The report of each Progress Meeting shall reflect any objection made to the report of the previous Progress Meeting and any response.

5.8. Project Coordination

5.8.1. If determined needed by CMHA, the Contractor or Subcontractor(s), the Contractor shall prepare Coordination Drawings for any Coordination Area.

A. The Contractor shall prepare the Coordination Drawings with Computer-Aided Design ("CAD") or Building Information Modeling ("BIM") software acceptable to CMHA.

B. The Coordination Drawings shall show the all affected work, including without limitation, plan and elevation dimensions.

5.8.2. After the Contractor completes the Coordination Drawings, the Contractor shall forward a copy of the Coordination Drawings to CMHA.

A. The A/E shall report any concerns in writing to the Coordination Participants within fourteen (14) calendar days after receiving the Coordination Drawings.

5.9. Additional Tests and Inspections

5.9.1. If the A/E or CMHA determines that any portion of the Work requires special inspection, testing, or approval not otherwise required under the Contract Documents, the A/E and/or CMHA shall order such inspection, testing, or approval.

5.9.2. If the special inspection, testing, or approval reveals Defective Work, the Contractor shall pay all associated costs and will not be entitled to any related adjustment of the Contract Times.

A. Those costs may include without limitation:

i. The cost of special inspection, testing, or approval;

ii. The cost of additional special inspections, testing, or approvals, to evaluate Remedial Work;

iii. The cost of correcting Defective Work; and

iv. All related CMHA-incurred fees and charges of contractors, engineers, architects, attorneys, and other professionals.

5.9.3. CMHA may deduct the costs described under the Contract Documents from payments then or thereafter due the Contractor.

A. If payments then or thereafter due to the Contractor are not sufficient to cover those amounts, the Contractor or it surety shall immediately pay the amount of the insufficiency to CMHA.

5.9.4. If the special inspection, testing, or approval reveals that the Work complies with the Contract Documents, and the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of the special inspection, testing, or approval, the Contractor may file a Claim by requesting a Change Order by giving written notice within seven (7) calendar days after the special inspection, testing, or approval.

5.9.5. If the Contractor is aware of the need of an inspection, testing, or approval, or of a need to have any inspection, testing, or approval completed by a particular time to avoid delay, then the Contractor shall timely communicate such information to CMHA.

5.9.6. Except as described in Additional Tests and Inspections, CMHA shall pay for any inspection, testing, or approval that did not become a requirement until after award of the Contract.

5.9.7. The Contractor shall coordinate with and give CMHA reasonable notice of the anticipated dates of all inspections, testing, or approvals.

5.10. Review of Contract Documents

5.10.1. Before starting each portion of the Work, the Contractor shall carefully study and compare the various Contract Documents relative to that portion of the Work, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the Site affecting it.

5.10.2. If the Contractor finds any perceived ambiguity, conflict, error, omission, or discrepancy on or between any of the Contract Documents, or between any of the Contract Documents and any Applicable Law, the Contractor, before proceeding with the Work, shall promptly submit a Request for Information ("RFI") to CMHA for an interpretation or clarification.

A. Before submitting any RFI, the Contractor shall carefully review the Contract Documents to ensure that the Contract Documents do not answer the RFI.

B. If Contractor indicates that the information requested in the RFI affects the critical path of the Project's Construction Progress Schedule and attaches the portion of the Project's Construction Progress Schedule that verifies that the information requested in the RFI affects the critical path, CMHA shall make all reasonable efforts to respond to the RFI within seven (7) business days of receiving the RFI.

5.10.3. If the Contractor believes that it is entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of clarifications or instructions issued in response to a RFI, the Contractor may submit a Claim by requesting a Change Order by giving notice within three (3) business days of receiving the RFI response.

5.10.4. If Contractor does not notify CMHA in accordance with 5.10.3 or any other section that addresses adjustments to the Contract Sum and Contract Time, the Contractor will have accepted the RFI response without an adjustment to the Contract Sum or Contract Time and irrevocably waives his right to submit or request an adjustment to the Contract Sum and/or Contract Time.

5.10.5. Frivolous RFI

A. If the Contractor submits a frivolous RFI, as determined by CMHA, Contractor shall be liable to CMHA for the costs related to the review and response of the RFI.

i. CMHA may deduct the costs described herein from payments then or thereafter due the Contractor.

ii. If payments then or thereafter due to the Contractor are not sufficient to cover CMHA's costs, the Contractor or it surety shall immediately pay the amount of the insufficiency to CMHA.

B. Frivolous RFIs may be returned unanswered.

5.10.6. Delays caused by improper or frivolous RFI's are the sole responsibility of the Contractor who shall waive the Contractor's right to seek adjustments to the Contract Sum and Contract Time.

5.11. Site Investigation and Conditions Affecting the Work

5.11.1. The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including, but not limited to:

A. Conditions bearing upon transportation, disposal, handling, and storage of materials;

B. The availability of labor, water, electric power and roads;

C. Uncertainties of weather, river stages, tides, or similar physical conditions at the site;

D. The conformation and conditions of the ground; and

E. The character of equipment and facilities needed preliminary to and during work performance.

5.11.2. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by CMHA, as well as from the drawings and specifications made part of this contract.

A. Any failure of the Contractor Site Investigation and Conditions Affecting the Work will not relieve the Contractor from responsibility for properly estimating or properly evaluating the difficulty and cost of successfully performing the Work without additional expense to CMHA.

5.11.3. CMHA assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by CMHA.

A. Nor does CMHA assume responsibility for any understanding reached or representations made concerning conditions which can affect the Work by any of its officers or agents before execution of this Contract, unless that understanding or representation is expressly stated in this Contract.

5.12. Protection of the Project

5.12.1. The Contractor shall protect the Project from weather and maintain the Work and all materials, apparatus, and fixtures free from injury or damage until Substantial Completion of the Work.

A. The Contractor shall at all times cover or protect the Work and materials.

B. The Contractor, at its own expense, shall remove, and replace with new, any Work damaged as a result of the Contractor's failure to provide coverage or protection.

C. After the date of Substantial Completion of the Work, CMHA is responsible for protecting and maintaining all materials, apparatus, and fixtures for the occupied portion of the Project from injury or damage.

5.12.2. The Contractor shall protect the Project and existing or adjacent property from damage at all times and shall erect and maintain necessary barriers, lateral support, furnish and keep lighted necessary danger signals at night, and take reasonable precautions to prevent injury or damage to individuals or property.

5.12.3. Temporary Heating

A. The Contractor shall provide and pay for temporary heating, covering, and enclosures necessary to protect all Work and materials against damage by dampness and cold, to dry out the Work, and to facilitate the completion of Work.

B. Any permanent heating equipment used by Contractor or Subcontractors shall be turned over to CMHA in the condition and at the time required by the specifications.

5.12.4. The Contractor shall not load, or permit any part of the Project to be loaded, in any manner that endangers the Project, or any proportion thereof.

A. The Contractor shall not subject any part of the Project or existing or adjacent property to stress or pressure that endangers the Project or property.

5.12.5. Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work sites, which are not to be removed under this Contract, and which do not unreasonably interfere with the Work required under this Contract.

B. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place.

i. If any limbs or branches of trees are broken during performance of this Contract, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as specifically directed by CMHA.

C. The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor.

i. Prior to disturbing the ground at the construction site, the Contractor shall ensure that all underground utility lines are clearly marked.

D. The Contractor shall shore up, brace, underpin, secure, and protect as necessary all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be affected by the excavations or other operations connected with the construction of the Project.

E. Any equipment temporarily removed as a result of work under this Contract shall be protected, cleaned, and replaced in the same condition as at the time of award of this Contract.

F. New work which connects to existing Work shall correspond in all respects with that to which it connects and/or be similar to existing Work unless otherwise required by the specifications.

G. No structural members shall be altered or in any way weakened without the written authorization of CMHA, unless such work is clearly specified in the Plans or specifications.

H. If the removal of the existing Work exposes discolored or unfinished surfaces, or work out of alignment, such surfaces shall be refinished, or the material replaced as necessary to make the continuous work uniform and harmonious.

i. This, however, shall not be construed to require the refinishing or reconstruction of dissimilar finishes previously exposed, or finished surfaces in good condition, but in different plans or on different levels when brought together by the removal of intervening work, unless such refinishing or reconstruction is specified in the plans or specifications.

I. The Contractor shall give all required notices to any adjoining or adjacent property owner or other party before commencement of any Work.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, (whether alleged or proven), demands, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs arising out of or related to the settlement or the loss of lateral support of adjoining property, any damages from changes in topography affecting drainage, and from all loss or expense and all damages for which CMHA may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

K. The Contractor shall repair any damage to vegetation, structures, equipment, utilities, or improvements, including those that are the property of a third party, resulting from failure to comply with the requirements of this Contract or failure to exercise reasonable care in performing the work.

i. If the Contractor fails or refuses to repair the damage promptly, CMHA may have the necessary Work performed and charge the cost to the Contractor.

5.12.6. Vibration, Noise, and Dust Control

A. The Contractor shall provide controls/barriers for vibrations, noise, and dust control in occupied buildings as required by the construction operations.

B. The Contractor will not be permitted to exhaust or release unfiltered air, dust, construction debris, or other undesirable products into the exterior atmosphere or into occupied areas of the building.

i. CMHA may limit or stop the Work if the Contractor does not maintain proper air-quality standards.

ii. Such stoppage may result in a charge to the Contractor.

C. In certain occupied buildings, tasks might be of such a nature that noise and vibration cannot be tolerated.

i. In such spaces and as approved by CMHA, Work may be scheduled for other than normal working hours.

ii. The Contractor is cautioned that weekend or overtime work, if required, shall be performed at no additional cost.

iii. Permission to work other than standard hours shall be received from CMHA prior to the occurrence.

iv. Weekend or overtime Work shall be reflected in the Construction Progress Schedule.

D. The Contractor is responsible for vibration control and control of transmission of noise arising from the Work.

E. Principal considerations that shall be given to noise and vibrations control are:

i. Noise control in compliance with Occupational Safety and Health Administration (OSHA) shall be for all areas of the facility, including equipment rooms, boiler rooms, and fan rooms.

ii. Vibration control to limit sound produced by construction equipment, and for protection of the equipment existing in the building and the building structure.

iii. Vibration control to provide for the maximum usefulness of the facility by keeping levels of vibration within ranges conducive to peaceful enjoyment of residential living or work or other uses for which the facility was designed

5.13. General Warranty - Materials, Equipment and Workmanship

5.13.1. The Contractor warrants to CMHA and A/E that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise.

A. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit.

B. Work, materials, or equipment not conforming to these requirements may be considered defective.

C. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage.

D. If required by the A/E, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

5.13.2. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA from and against all claims, (whether alleged or proven), demands, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, arising out of or relating to the Contractor's breach of any warranty obligations.

A. The Contractor's obligation shall be joint and several.

5.13.3. Additional Warranties

A. The Contractor gives the Owner the following additional warranties:

i. If the Contractor's Work includes all or part of the exterior roofing system, provided that the A/E has designed the roofing system to be weather tight, the Contractor warrants that the roofing system will be weather tight; and

ii. If the Contractor's Work includes all or part of the exterior wall system, provided that the A/E has designed the wall system to be weather tight, the Contractor warrants that the wall system will be weather tight.

(a) Weather tight shall mean the roofing and/or wall system does not permit any infiltration of water in any form that would have any adverse effect on the Owner's operations or the Project.

5.13.4. The Contractor shall, prior to Contract Completion and as a condition precedent to final payment to Contractor, assign to CMHA all manufacturer's warranties related to the materials and labor used in the Work and further agrees to perform the Work in such manner as to preserve any and all such manufacturer's warranties and deliver to the A/E the warranties, project manual, operating procedures, and other materials related to each of the building systems and materials included in the Contractor's Work and as required by the Specifications.

5.13.5. Upon notice of the breach of any of the warranties or guarantees identified herein, or any other warranties or guarantees under the Contract Documents, the Contractor, in addition to any other requirements in the Contract Documents, shall commence to correct such breach and all damage resulting therefrom within two (2) business days from written notice thereof, thereafter use its best efforts to correct such breach and damage to the satisfaction of CMHA and A/E, and, except when an extension of time is granted in writing by CMHA, correct such breach and damage to the satisfaction of CMHA within thirty (30) calendar days of such notice, or such other time as provided in the notice; provided, however, that if such notice is given after final payment the 2-day period shall be extended to seven (7) calendar days.

A. If the Contractor fails to commence to correct such breach and damage, or to correct such breach or damage as provided above, the Owner, without prejudice to any of its other rights or remedies at law or under the Contract Documents, may correct the breach without further notice to Contractor.

B. The Contractor shall pay the Owner's reasonable costs and expenses incurred in connection with the or related to such correction and/or breach, including without limitation the Owner's administrative, legal, and consulting expenses and additional service fees of the A/E.

C. The foregoing warranties and obligations of the Contractor shall survive final payment and/or termination of the Contract and shall not be limited by any other terms contained in the Contract Documents.

D. If the Contractor fails to pay the Owner any amounts due hereunder, the Contactor shall pay the Owner, in addition to the amounts due, a late payment fee of one and one-half percent (1.5%) per month for each month or part thereof that the payments are not paid when due.

5.13.6. Contractor shall bring to or store at the Site only the materials and equipment required for the Work.

A. If possible, materials and equipment should be installed in their final positions when brought to the Site.

5.13.7. All equipment, material, and articles furnished under this Contract shall be of the most suitable grade for the purpose intended, unless otherwise specifically provided in this Contract.

A. References in the Contract to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition.

B. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of, and as approved by CMHA in writing, is equal to that named in the specifications, unless otherwise specifically provided in this Contract so long as Contractor has submitted a substitution request to CMHA.

C. If the substituted material has not been approved by CMHA in writing, the substituted material may be considered Defective Work by CMHA or A/E.

5.13.8. Approval of Equipment and materials

A. The Contractor shall obtain CMHA's approval of the machinery and mechanical and other equipment to be incorporated into the work.

i. When requesting approval, the Contractor shall furnish to CMHA the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment

ii. When required by this contract or by CMHA, the Contractor shall also obtain CMHA's approval of the material or articles which the Contractor contemplates incorporating into the work.

iii. When requesting approval, the Contractor shall provide full information concerning the material or articles.

iv. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

B. When required by the specifications or CMHA, the Contractor shall submit appropriately marked samples (and certificates related to them) for approval at the Contractor's expense, with all shipping charges prepaid.

i. The Contractor shall label, or otherwise properly mark on the container, the material or product represented, its place of origin, the name of the producer, the Contractor's name, and the identification of the construction project for which the material or product is intended to be used.

C. Certificates shall be submitted electronically in triplicate, describing each sample submitted for approval and certifying that the material, equipment or accessory complies with contract requirements.

i. The certificates shall include the name and brand of the product, name of manufacturer, and the location where produced.

D. Approval of a sample shall not constitute a waiver of CMHA's right to demand full compliance with contract requirements.

i. Materials, equipment and accessories may be rejected for cause even though samples have been approved.

E. Wherever materials are required to comply with recognized standards or specifications, such specifications shall be accepted as establishing the technical qualities and testing methods, but shall not govern the number of tests required to be made nor modify other Contract requirements.

i. CMHA may require laboratory test reports on items submitted for approval or may approve materials on the basis of data submitted in certificates with samples.

ii. Check tests will be made on materials delivered for use only as frequently as CMHA determines necessary to insure compliance of materials with the specifications.

iii. The Contractor will assume all costs of retesting materials which fail to meet contract requirements and/or testing materials offered in substitution for those found deficient.

F. After approval, samples will be kept in the Project office until completion of work.

i. They may be built into the work after a substantial quantity of the materials they represent has been built in and accepted.

G. Requirements concerning lead-based paint

i. The Contractor shall comply with the requirements concerning lead-based paint contained in the Lead-Based Paint Poisoning Prevention Act.

5.13.9. Substitutions

A. If the Contractor provides approved Substitutions that require changes to the Contract Documents, the Contractor shall be solely responsible for the additional costs incurred as a result, including without limitation changes to the design by the A/E.

B. CMHA shall consider Requests for Substitutions after the bid opening only when the Contractor can conclusively demonstrate CMHA the following conditions:

i. The specified Basis of Design Components, Acceptable Components, or previously approved Substitutions through no fault of the Contractor are not available; or

ii. The specified Basis of Design Components, Acceptable Components, or previously approved Substitutions will not perform as designed or intended.

C. The Contractor's incorporation of unapproved Substitutions in the Work shall constitute Defective Work.

D. If the Contractor provides an unacceptable Component, the Contractor shall be solely responsible for the costs of coordination and modification required.

5.14. Specifications and Drawings for Construction

5.14.1. The Contractor shall keep on the work site a stamped, permit set of the drawings and specifications and shall at all times give CMHA access thereto.

A. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both.

B. In case of difference between drawings and specifications, the specifications shall govern.

C. In case of a discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to CMHA, who shall promptly make a determination in writing.

D. Any adjustment by the Contractor without such determination shall be at its own risk and expenses.

E. CMHA shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

5.14.2. Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of CMHA is intended.

5.14.3. Where "shown," indicated", "detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this Contract unless otherwise stated, the word "provided" as used herein shall be understood to mean "provide complete in one place" that is "furnished and installed".

5.14.4. "Shop Drawings" means drawings, submitted to CMHA by the Contractor, subcontractor or any lower tier subcontractor, showing in detail, 1) the proposed fabrication and assembly of structural elements and 2) the installations (i.e., form, fit, and attachment details) of materials of equipment.

A. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the Contract.

B. CMHA may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

5.14.5. If this Contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with other Contract requirements and shall indicate its approval thereon as evidence of such coordination and review.

A. Shop Drawings submitted to the A/E without evidence of the Contractor's approval may be returned for resubmission.

B. CMHA will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate CMHA's reasons therefore.

C. Any Work done before such approval shall be at the Contractor's risk.

D. Approval by the A/E shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this Contract, except with respect to approved variations.

5.14.6. If shop drawings show variations from the Contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission.

A. If the A/E approves any such variation and CMHA concurs, CMHA shall issue an appropriate modification to the Contract, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

5.14.7. It shall be the responsibility of the Contractor to make timely requests to CMHA for such large scale and full size drawings, color schemes, and other additional information, not already in possession, which shall be required in the planning and production of the work.

A. Such requests may be submitted as the need arises, but each such request shall be filed with ample time to permit appropriate action to be taken by all parties involved so as to avoid delay.

5.14.8. The Contractor shall electronically submit to CMHA for approval (unless otherwise indicated) all shop drawings as called for under the various headings of the specifications.

A. As required by CMHA, the Contractor, upon completing the work under this Contract, shall furnish a complete set of drawings as finally approved.

B. These drawings show all changes and revisions made up to the time the work is completed and accepted.

5.14.9. Specifications and Drawings for Construction shall be included in all Subcontracts at any tier.

A. It shall be the responsibility of the Contractor to ensure that all shop drawings prepared by Subcontractors are submitted to CMHA.

5.15. As Built Drawings

5.15.1. "As-built drawings," means drawings submitted by the Contractor or subcontractor at any tier to show the construction of a particular structure or Work as actually completed under the Contract.

A. "As-built drawings" shall be synonymous with "Record Drawings".

5.15.2. As required by CMHA, the Contractor shall provide CMHA accurate information to be used in the preparation of permanent as-built drawings.

A. For this purpose, the Contractor shall record on one set of Contract drawings all changes from the installations originally indicated, and record final locations of underground lines by depth from finish grade and by accurate horizontal offset distances to permanent surface improvements such as buildings, curbs, or edges of walks.

5.15.3. As Built Drawings shall be included in all subcontracts at any tier.

5.15.4. It shall be the responsibility of the Contractor to ensure that all As-Built Drawings prepared by Subcontractors are submitted to CMHA.

5.16. Project Document Maintenance and Submittal

A. During Construction

i. The Contractor shall maintain in good order at a secure location on the Site:

(a) A complete copy of all Contract Documents; Shop Drawings, Product Data, samples and similar required submittals; manufacturer operating and maintenance instructions; certificates; warranties; RFIs and responses thereto; and other Project-related documents, all marked currently and accurately to record field changes and selections made during construction and to show actual installation where installation varies from Work as originally shown, including the exact location and depth of underground utility lines; and

(b) A set of Drawings as approved by any applicable jurisdiction and Specifications.

B. Before submitting each Contract Payment Request, the Contractor shall record all changes on the Contract Documents, neatly in a contrasting color, noting new information not shown on the original Contract Documents.

i. Failure to record all changes may cause payment to be withheld or delayed by CMHA.

C. The Contractor shall keep a record of changes made to the Specifications, noting particularly any approved variation from manufacturer's installation instructions and recommendations.

D. If the Contractor uses Shop Drawings to indicate as-built conditions, the Contractor shall cross-reference the Shop Drawing sheet numbers to the corresponding sheet numbers on the Contract Documents.

i. The Contractor shall note related numbers where applicable.

5.16.2. Before Contract Completion

A. The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall organize the As-Built Documents into manageable sets, bind the sets with durable paper cover sheets, and deliver the As-Built Documents to CMHA.

B. The Contractor's As-Built Documents submission shall include, but is not limited to:

i. Certificate of Occupancy;
ii. Inspection certificates for pressure piping, elevator, boiler, electrical, plumbing or piping purification, etc.
iii. Letter of Approval from the local fire authority or State Fire Marshal for the fire suppression system;
iv. Operation and Maintenance Manuals, organized into suitable sets of manageable size;
v. Indexed data bound in individual binders, with pocket folders for folded sheet information and appropriate identification marked on the front and the spine of each binder;
vi. Neatly and accurately marked sets of As-Built Documents, and other Contract Documents reflecting the actual construction of the Project;
vii. Detailed Drawings reflecting the exact location of any concealed utilities, mechanical or electrical systems, and components;
viii. Assignment to CMHA of all warranties and guarantees, including the most-recent address and telephone number of any Subcontractors or manufacturers;
ix. An affidavit to certify that all Subcontractors have been paid in full for all Work performed or materials furnished for the Project;
x. A final lien waiver for both the Contractor and all Subcontractors of any tier;
xi. Final certified payroll reports; and
xii. An affidavit to certify that the Contractor and each of its Subcontractors, regardless of tier, have complied with all requirements of ORC.

C. By submitting the As-Built Documents to CMHA, the Contractor certifies that its As-Built Documents are complete, correct, and accurate.

5.17. Temporary Buildings and Transportation of Materials

5.17.1. Temporary buildings (e.g., storage sheds, shops, offices, sanitary facilities) and utilities may be erected by the Contractor only with the approval of CMHA and shall be built with labor and materials furnished by the Contractor without expense to CMHA.

A. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work.
B. With the written consent of CMHA, the buildings and utilities may be abandoned and need not be removed.

5.17.2. The Contractor shall, as directed by CMHA, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by CMHA.

A. When materials are transported in prosecuting the Work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any federal, state, or local law or regulation.
B. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage.
C. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

5.18. Facilities

5.18.1. The Contractor shall provide and maintain in a clean condition:

A. Suitable facilities, including temporary facilities, equipment, services, and enclosed storage for its use at the Site;
B. Adequate space, equipment, and furnishings to conduct progress meetings, and store approved documents and permits; and
C. Adequate sanitary facilities for use by all Persons at the Site.

5.19. Progress Cleaning

5.19.1. The Contractor shall remove all waste materials, rubbish, and mud attributable to the Work in accordance with the Specifications, if applicable, and to an appropriate disposal location at, or near, the Site.

5.19.2. The Contractor shall perform weekly broom cleaning of hard flooring surfaces in the area of the Work.

5.19.3. The Contractor shall remove, at the end of each working day or more frequently, as appropriate, for the Project, all waste materials and rubbish from the disposal location at, or near, the Site.

5.19.4. The Contractor shall remove, as appropriate for the Project or as the A/E or CMHA directs, any waste materials or rubbish from areas adjacent to the Project.

5.19.5. The Contractor shall dispose of waste materials, rubbish, and construction debris in a lawful manner in approved recycling facilities or landfills and record of such disposal shall be available upon written request of CMHA.

5.19.6. If the Contractor fails to clean up during the progress of the Work, CMHA may clean up on behalf of the Contractor and at the Contractor's expense.

A. If the Contractor fails to maintain the areas adjacent to the Project clean and free of waste materials and rubbish, CMHA may also direct the local jurisdiction responsible for the area to have the area cleaned to its satisfaction at the Contractor's expense.

B. CMHA may deduct the cleaning costs from payments then or thereafter due the Contractor.

i. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to CMHA.

5.19.7. The Contractor shall remove excavated material and spoil to a suitable off-site location approved by CMHA.

A. If CMHA designates a location on its property for disposal or storage of clean topsoil and/or subsoil in the Contract Documents, the Contractor shall remove such materials to the designated location.

5.20. Use of Premises

5.20.1. The Contractor shall use corridors, stairs, and elevators as designated by CMHA and only during those times that are designated by CMHA.

A. The Contractor shall exercise extreme care to not exceed the carrying capacity of elevators or damage the cab interior in any way.

5.20.2. Loitering or wandering through interior of buildings or exterior grounds outside the limits of the Work will not be permitted.

5.20.3. The Contractor shall confine its apparatus, materials, and the operations of its workers to the limits indicated by law, ordinances, permits and the directions of CMHA.

5.20.4. Unless expressly required or approved by CMHA, no signs or advertising of any kind will be permitted on or about the Site, except those appearing on trucks and trailers.

5.20.5. CMHA Use of Premises / Possession Prior to Completion

A. CMHA shall have the right to take possession of or use any completed or partially completed part of the Work.

i. Before taking possession of or using any work, CMHA shall furnish the Contractor a list of items of Work remaining to be performed or corrected on those portions of the Work that CMHA intends to take possession of or use.

ii. However, failure of CMHA to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the Contract.

iii. CMHA's possession or use shall not be deemed acceptance of Work under the Contract.

B. While CMHA has such possession or use, the Contractor shall be relieved of the responsibility for:

i. The loss of or damage to the Work resulting from CMHA's possession or use, notwithstanding the terms herein;

ii. All maintenance costs on the areas occupied; and

iii. Furnishing heat, light, power, and water used in the areas occupied without proper remuneration therefore.

C. If requested by the Contractor and if prior possession or use by CMHA delays the progress of the Work or causes additional expense to the Contractor, an equitable adjustment shall be made in the Contract Sum, the Contract Time, or both, and the Contract shall be modified in writing accordingly.

5.21. Smoking and Tobacco Products

5.21.1. Smoking is not permitted at any property under construction, unless CMHA has a specifically designated area for smoking, and is not permitted within 50 feet of any entrance of a CMHA owned building.

A. This prohibition applies to new construction and rehabilitation.

B. The Contractor shall enforce these restrictions on any individual employed by the Contractor, or a Subcontractor.

5.22. Correction of the Work

5.22.1. Before Substantial Completion

A. If the Contractor provides Defective Work or fails or neglects to perform the Work in accordance with the Construction Progress Schedule, CMHA or the A/E may issue a written notice to the Contractor and Contractor's Surety directing the Contractor to correct the Defective Work or recover schedule deficiencies.

i. Unless otherwise specified in that written notice, the Contractor shall begin to correct the Defective Work and recover the schedule deficiencies within no more than three (3) business days after CMHA issues the written notice.

B. If the Contractor fails to commence and diligently pursue correction of Defective Work or recovery of schedule deficiencies within three (3) business days of Contractor's receipt of written notice from CMHA or the A/E, CMHA may correct the Defective Work or take action to recover schedule deficiencies without giving further notice to the Contractor or Contractor's Surety.

5.22.2. During the Correction Period

A. If CMHA issues a notice during the Correction Period, CMHA may correct the Defective Work itself without giving further notice to the Contractor or Contractor's Surety if the Contractor fails to:

i. Notify CMHA in writing of the Contractor's intent to correct the Defective Work within three (3) business days after CMHA issues the notice; and

ii. Thereafter promptly commence and diligently pursue correction of Defective Work.

B. *The Correction Period:*

i. Commences in accordance with 23.1.41;

ii. Relates only to the Contractor's specific obligation and opportunity to correct the Work during the Correction Period;

iii. Does not establish a period of limitation with respect to any of the Contractor's other obligations under the Contract Documents;

iv. Has no relationship to the time within which CMHA may seek to enforce the Contract; and

v. Does not establish a period of limitation with respect to the commencement of litigation to establish the Contractor's liability under the Contract or otherwise.

C. *After the Correction Period:*

i. CMHA may correct, at the Contractor's expense, the Defective Work without giving further notice to the Contractor or Contractor's Surety if the Contractor or Contractor's surety fails to

(a) Notify CMHA in writing of the intent to correct the Defective Work; and

(b) Promptly commence and diligently pursue correction of Defective Work.

5.22.3. After Substantial Completion

A. In addition to the Contractor's other obligations under the Contract Documents, if any of the Work is found to be Defective Work after Substantial Completion, the Contractor shall correct it promptly after receipt of written notice from CMHA to do so, unless CMHA has previously acknowledged and accepted the Defective Work in writing.

B. CMHA may send a copy of the written notice to the Contractor's Surety, but are not obligated to do so.

5.22.4. Emergency Correction of Defective Work

A. Notwithstanding any other provision of the Contract, if in CMHA's opinion the Defective Work presents a threat of imminent harm or danger to people, property, or the environment, CMHA may order the Contractor to immediately correct Defective Work or CMHA may correct the Defective Work, at Contractor's expense, itself without any prior notice to the Contractor or Contractor's Surety.

5.22.5. Responsibility for Costs of Correction

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, (whether alleged or proven), demands, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, associated with the correction of Defective Work and the recovery of schedule deficiencies.

B. Those costs and damages may include, but are not limited to:

i. The related fees and charges of contractors, engineers, architects, attorneys, and other professionals; and

ii. The cost of correcting or replacing adjacent work.

C. CMHA may deduct those costs and damages from payments then or thereafter due the Contractor.

i. If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to CMHA.

6. ARTICLE VI SUBCONTRACTORS

6.1. Evaluation and Approval

6.1.1. When submitting its Bid, the Contractor shall submit a Subcontractor and Material Supplier Declaration form through which the Contractor identifies its Subcontractor.

A. Provide list of subcontractors and material supplier and equipment with bid.

6.1.2. Within ten (10) calendar days after the Notice to Proceed, the Contractor shall submit to CMHA, an **updated** Subcontractor and Material Supplier Declaration form.

6.1.3. If CMHA rejects any proposed Subcontractor, the Contractor shall propose a replacement Subcontractor with no adjustment of the Contract Sum.

A. The proposed replacement will also be evaluated by CMHA.

6.1.4. The Contractor's failure to timely submit the information regarding a proposed Subcontractor may result in withholding payment to Contractor.

6.2. Suspension/Debarment

6.2.1. The Contractor shall not enter into any Subcontract with any Subcontractor who has been temporarily denied participation in a HUD program or who has been suspended or debarred from participating in contracting program by any agency of the United States Government or the State of Ohio.

6.3. Contractor's Responsibility

6.3.1. The Contractor shall be as fully responsible for the acts or omissions of its Subcontractors and of persons either directly or indirectly employed by them as for the acts or omissions of persons directly employed by the Contractor, and is responsible for scheduling and coordinating the Work of the Subcontractors.

6.3.2. The Contractor is fully responsible for any delay, interference, disruption, or hindrance attributable to the Contractor's Subcontractors.

6.3.3. The Contractors shall require that each of its Subcontractors have a competent supervisor at the Site whenever the Subcontractor is performing Work.

6.3.4. The Contractor shall bind its Subcontractors to the terms and conditions of the Contract Documents, so far as applicable to the Work of the Subcontractor, and shall not agree to any provision, which seeks to bind CMHA with terms inconsistent with or at variance from the Contract Documents.

6.3.5. The Contractor will not be relieved of its full responsibility for Subcontractors and their performance of the Work by:

A. The participation of CMHA, HUD, or the A/E in the processes described under ARTICLE VI SUBCONTRACTORS or other related provisions of the Contract Documents; or

B. CMHA's rejection of a Subcontractor or failure to reject a Subcontractor.

6.4. Mandatory Contract Provisions/Forms

6.4.1. The Contractor shall insert appropriate clauses in all Subcontracts to bind Subcontractors to the terms and conditions of this Contract insofar as they are applicable in the work of Subcontractors.

6.4.2. CMHA reserves the right to reassign accepted agreements

6.4.3. Nothing contained in this Contract shall create any contractual relationship between any Subcontractor and CMHA or between the Subcontractor and HUD.

6.4.4. The Contractor must include in the contract with its Subcontractors the applicable labor provisions and prevailing wages as was provided to the Contractor by CMHA.

6.4.5. No less than ten (10) calendar days before the Work is to be performed by a Subcontractor, or within a shorter period as mutually agreed by the Contractor and CMHA, the Contractor shall submit to CMHA a complete copy of the executed Subcontract between the Contractor and Subcontractor.

6.5. Replacement of Subcontractors

6.5.1. The Contractor shall not replace any Subcontractor after execution of the Subcontract without prior written approval of CMHA.

6.5.2. The Contractor shall not add any subcontractors after the Contract Execution without updating the Material supplier and subcontractor form or prior to written approval of CMHA.

6.6. Contingent Assignment of Subcontract

6.6.1. The Contractor hereby assigns its Agreement with each Subcontractor to CMHA provided that the assignment is effective only after termination of the Contract by CMHA and only for those agreements that CMHA accepts by notifying Contractor and applicable Subcontractor in writing.

6.7. Prompt Payment of Subcontracts

6.7.1. The Contractor shall make payments to the Subcontractor in accordance with Applicable Law, including ORC that include, without limitation, the requirements under 6.7 - Prompt Payment of Subcontracts.

6.7.2. If a Subcontractor requests payment in time to allow the Contractor to include the request in its Contractor Payment Application Request the Contractor, within ten (10) calendar days after receipt of payment from CMHA, shall pay to the:

A. Subcontractor, an amount equal to the percentage of completion of the Subcontractors contract allowed by CMHA for the amount of labor or work performed;

B. Material Supplier, an amount that is equal to all or a portion of the invoice for materials which represents the materials furnished by the material supplier

6.7.3. The Contractor may reduce the amount paid by any retainage provision contained in the Contract, invoice, or purchase order between the Contractor and Subcontractor and may withhold amounts that may be necessary to:

A. Resolve disputed liens or claims involving the Work or labor performed by the Subcontractor; or

B. Account for failure of the Subcontractor to perform its obligations under its agreement with the Contractor required under ORC

6.7.4. Labor Payments

A. Within ten (10) calendar days of receipt of payment from CMHA, the Contractor shall pay Subcontractor in the following manner:

i. Partial payments to the Subcontractor for labor performed under either a Unit Price or lump sum Subcontract shall be made at the rate of 92 percent of the amount invoiced through the Subcontractor's request for payment that shows the Work of the Subcontractor is 50% complete.

ii. After the Work of the Subcontractor is 50 percent complete, as evidenced by payments of at least 50 percent of the total amount due under the Subcontract, no additional funds shall be retained from payments for labor.

6.7.5. Material Payment

A. Required by ORC for payment to Contractor by CMHA

i. The Contractor shall pay the Subcontractor at the rate of 95% of the invoice cost, not to exceed the scheduled value in a unit price or lump sum Subcontract, for materials delivered to the Site, or other offsite storage location approved by CMHA, provided the Subcontractor provides the information required with its request for payment.

ii. The Contractor shall pay the Subcontractor at the rate of 100% of the scheduled value for materials incorporated into the Project.

6.7.6. If Contractor fails to comply with the payment provisions set forth, the Contractor shall pay to the applicable Subcontractor, in addition to any payment due, interest in the amount of 18 percent per annum of the payment due, beginning the eleventh day following the receipt of payment from CMHA and ending on the date of full payment of the payment due plus interest.

6.7.7. If CMHA receives a Claim Affidavit from a Subcontractor, Subcontractor shall proceed in accordance with Applicable Law, including Ohio Revised Code.

6.7.8. Laborers, Subcontractors, and Material Suppliers may secure payment rights in accordance with Applicable Law, including Ohio Revised Code.

6.8. Subcontracting with Small and Minority Firms, Women's Business Enterprise, and Labor Surplus Area Firms

6.8.1. The Contractor shall take the following steps to ensure that, whenever possible, Subcontracts are awarded to small business firms, minority firms, women's business enterprises, and labor surplus area firms:

A. Placing qualified small and minority businesses and women's business enterprises on solicitations lists;

B. Ensuring that small and minority businesses and women's business enterprises are solicited whenever they are potential resources

C. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses and women's business enterprises;

6.8.2. Establishing delivery schedule, where the requirements of the Contract permit, which encourages participation by small and minority businesses and women's business enterprises; and

6.8.3. Using the services and assistance of the U.S. Small Business Administration, the Minority Business Development Agency of the U.S. Department of Commerce, and State and local governmental small business agencies

7. ARTICLE VII PAYMENTS

7.1. CMHA Obligation

7.1.1. CMHA shall pay the Contractor the price as provided in the Contract.

7.2. Forms

7.2.1. Unless expressly authorized to the contrary, Contractor must use appropriate CMHA forms.

7.3. Step One – Pencil Application

7.3.1. The purpose of a pencil application is assisting the Contractor in identifying any potential error or omission in the pay application.

A. If submitted timely (as set forth below) CMHA will review and help identify any potential issues. However, the CMHA Construction Administrator's approval or suggestion does not guarantee approval of the payment application by the CMHA.

7.3.2. The Contractor shall initially submit a Pencil Application by no later than the 15th of each month.

A. The CMHA Construction Administrator will review the Pencil Application, and make any suggested corrections and return to the Contractor in approximately two (2) business days.

7.3.3. The Contractor shall then submit the final payment application to the CMHA Construction Administrator by the 23rd of each month.

7.3.4. Failure to submit a pencil application may result in a significant delay in payment.

7.4. Progress Payments

7.4.1. CMHA shall make progress payments approximately every forty-five (45) calendar days as the work proceeds on estimates of Work accomplished which meets the standards of quality established under the Contract, as approved by CMHA.

A. Subject to CMHA's written determination and approval more frequent payments may be made to contractors which are qualified as small businesses.

7.4.2. Before the first progress payment under this contract, the Contractor shall furnish, in such detail as requested by CMHA, a breakdown of the total contract price showing the amount included therein for each principal category of the work, which shall substantiate the payment amount requested in order to provide a basis for determining progress payments.

A. The breakdown shall be approved by CMHA and must be acceptable to HUD.

B. If the contract covers more than one Project, the Contractor shall furnish a separate breakdown for each.

C. The values and quantities employed in making up this breakdown are for determining the amount of progress payments and shall not be construed as a basis for additions to or deductions from the Contract Sum.

D. The Contractor shall prorate its overhead and profit over the construction period of the Contract.

7.4.3. The Contractor shall submit, on forms provided by CMHA, periodic estimates showing the value of the work performed during each period based upon the approved breakdown of the Contract Sum.

A. Such estimates shall be submitted not later than nine (9) calendar days in advance of the date set for payment and are subject to correction and revision as required.

B. The estimates must be approved by the CMHA prior to payment.

C. If the contract covers more than one project, the Contractor shall furnish a separate progress payment estimate for each.

D. Each payment application should include affidavits for the Contractor, Sub Contractors and Material Suppliers. Lien waivers should be submitted as proof of payment for the prior payment application affidavits.

7.4.4. Along with each request for progress payments and the required estimates, the Contractor shall furnish the following certification, or payment shall not be made:

A. I hereby certify, to the best of my knowledge and belief, that:

i. The amounts requested are only for performance in accordance with the specifications, terms,

ii. Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements; and

iii. This request for progress payments does not include any amounts which the prime Contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract.

7.5. Allowances

7.5.1. The Contract Sum includes the Allowances (if any) identified in the Contract.

7.5.2. All allowances include the costs to the Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes.

7.6. Unit Prices

7.6.1. Where the Contract provides that all or a part of the Work is to be Unit Price Work, initially that Contract Sum will include for all Unit Price Work:

A. An amount equal to the sum of the established Unit Prices for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Contract.

B. The Contractor's fee on that Unit Price Work.

7.6.2. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Sum.

A. CMHA will determine the actual quantities and classifications of Unit Price Work performed by the Contractor.

7.6.3. Before final payment, an appropriate Change Order will be issued to reconcile the Contract Sum so that it reflects actual amount due to the Contractor on account of Unit Price Work actually performed.

7.7. Schedule of Values

7.7.1. Within seven (7) calendar days after issuance of Letter of Intent or other period as mutually agreed by the Contractor and CMHA, the Contractor shall submit to CMHA a Schedule of Values on a form provided for by CMHA, with separate amounts shown for labor and materials for each branch of Work.

A. The Contractor shall clearly indicate on the Schedule of Values, but is not necessarily limited to, the cost of payment and performance bond(s), permit costs, the amount(s) allocated, including separate items for the Contractor's Fee (Overhead and Profit), and the amount(s) of labor and materials, as appropriate.

7.7.2. The grand total shown on the Schedule of Values shall equal the total Contract Sum.

7.7.3. CMHA may use the approved Schedule of Values to determine cost or credit to CMHA resulting from any change in the Work.

A. The first items shall be a breakdown of the General Conditions Cost.

B. The amounts for labor and materials shall accurately reflect the cost for each item.

i. The Contractor shall clearly indicate on the Schedule of Values, the amount(s) allocated, including separate items for Contractor's Fee (overhead and profit), for each Section 3 certified Business used in the performance of the Work.

ii. Contractor's Fee shall be included in the totals for labor and materials.

C. If the material allocation exceeds 55 percent of the Contract Sum, the Contractor shall provide, upon request, sufficient information to support the higher percentage.

D. Subcontract Work shall show amounts for labor and materials.

i. Fringe benefits shall be shown as a part of labor costs.

E. When more than one major structure is included in the Work, the Contractor shall subdivide the Schedule of Values accordingly, with cost details for each structure shown separately.

F. The line items shall be coordinated with line items in the Construction Progress Schedule, which may require division of items of Work by area of the Project by floor, phase, or other appropriate area.

G. Mechanical and electrical Work shall be included in separate line items for all major pieces of equipment, and group smaller equipment items by type.

H. Line items shall be included for each Allowance, Punch List Work, Project Record Document Submittals, delivery of attic stock, and specified demonstrations and training.

7.7.4. CMHA may return the Schedule of Values to the Contractor for re-submittal if it does not meet the requirements or contains insufficient items or details of the Work, or approve the Schedule of Values if CMHA determines that it conforms to section 7.7

7.7.5. No payment shall be made until the CMHA has approved the Contractor's Schedule of Values.

7.8. Labor Payments/Retainage

7.8.1. Partial payments to the Contractor for labor performed under either a Unit Price or lump sum Contract shall be made at the rate of 90 percent of the amount invoiced through the Contractor Payment Request.

7.9. Material Payments/Retainage

7.9.1. CMHA shall pay the Contractor at the rate of 100 percent of the scheduled value for materials incorporated into the Project.

7.9.2. CMHA shall pay the Contractor at the rate of 90 percent of the invoice cost, not to exceed the scheduled value in a Unit Price or lump sum Contract, for materials delivered to the Site, or other off-Site storage location approved by CMHA provided the Contractor provides the following information with the Contractor Payment Request:

A. A list of the fabricated materials consigned to the Project, giving the place of storage, together with copies of invoices, in order to verify quantity and cost; and

B. A certification of materials stored off-site, prepared by the Contractor and signed by CMHA to evidence that the materials are in conformity with the Specifications and have been tagged with the Project name and number for delivery to the Project.

7.9.3. CMHA shall pay the balance of the scheduled value when the materials are incorporated into and become a part of the Project.

7.9.4. When payment is allowed for materials delivered to the Site or other approved off-site storage location but not yet incorporated into the Project, the materials are the property of CMHA.

7.9.5. CMHA may, at its sole discretion, retain any material not ultimately incorporated into the Project or return it to the Contractor for credit of an amount proportionate to the value of the extra materials.

7.9.6. Release of Retainage

A. When the Contractor has achieved Substantial Completion of all Work, and there is no other reason to retain funds; upon request of the Contractor, the funds retained in connection with that Work shall be released and paid to the Contractor, withholding only that amount necessary to assure faithful completion in the sole discretion of CMHA, including but not limited to compliance with CLOSEOUT.

7.10. Payments Withheld

7.10.1. CMHA may withhold funds from or may assess Liquidated Damages against a Contractor Payment Request.

7.10.2. CMHA may decline to approve any Contractor Payment Request or part thereof, or nullify any previous Contractor Payment Request, in whole or in part, to the extent necessary in CMHA's sole opinion to protect CMHA from loss because of:

A. Defective Work not remedied;

B. Overpayment of any schedule of values line item without prior approval of related change order by Contracting Officer;

C. Overpayment due to calculation error;

D. Damage caused by the Contractor;

E. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

F. Reasonable evidence that the Work will not be completed within the Contract Times, and that the unpaid balance would not be adequate to cover damages under the Contract Documents for the anticipated delay;

G. Failure to comply with Applicable Law including, but not limited to, the requirements of ORC.

7.11. Payment Request

7.11.1. The Contractor and each of its Subcontractors, regardless of tier, shall execute a Payment Release Affidavit to certify that the Contractor and each of its Subcontractors, regardless of tier, have complied with all applicable requirements of ORC, and to certify that all of its Subcontractors have been paid in full for all Work performed or materials furnished under the Contract.

7.11.2. CMHA shall pay Contractor in approximately forty-five (45) calendar days from the date of acceptance of the Payment Request.

7.11.3. The Contractor, as a condition precedent to final payment, shall complete all requirements of the Contract Documents.

7.11.4. Acceptance of final payment by the Contractor or a Subcontractor constitutes the payee's waiver of all claims against CMHA expect those previously made in writing and identified by that payee as unsettled at the time of the final Contractor Payment Request.

8. ARTICLE VIII CONTRACT MODIFICATIONS

8.1. Changes in the Work

8.1.1. Except as provided, no order, statement or conduct of CMHA shall be treated as a change or entitle the Contractor to an equitable adjustment.

8.1.2. Only CMHA's Contracting Officer has authority to modify any term or condition of this Contract.

A. Any Contract modification shall be authorized in writing.

8.1.3. The Contracting Officer may modify the contract unilaterally:

A. Pursuant to a specific authorization stated in a Contract clause; or

B. For administrative matters which do not change the rights or responsibilities of the parties.

8.1.4. All other Contract Modifications shall be in the form of supplemental agreements signed by the Contractor and CMHA.

A. If notice of any change affecting the Contract is required by the provision of any Bond, notice is the Contractor's responsibility.

8.1.5. Except as expressly stated herein, the Contractor's failure to obtain prior written authorization from CMHA for a change in the Work constitutes a waiver by the Contractor of an adjustment to the Contract Sum or Contract Time or both.

8.1.6. The Contractor shall perform all changes in the Work under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly with the change unless otherwise provided in the Change Order or order for a minor change in the Work.

8.1.7. HUD Approval

A. When a proposed modification requires the approval of HUD prior to its issuance; such modification shall not be effective until the required approval is received by CMHA.

8.2. Change Order

8.2.1. CMHA may order changes in the Work without invalidating the Contract and such change in Work may be accomplished, by Change Order or an order for a minor change in the Work.

8.2.2. CMHA may, at any time, without notice to the sureties, by written order designated or indicated to be a change order, make changes in the Work within the general scope of the Contract including, but not limited to, changes:

A. In the specifications (including drawings and designs);

B. In the method or manner of performance of the Work;

C. CMHA-furnished facilities, equipment, materials, services, or site; or

D. Directing the acceleration of the Work.

8.2.3. If any change causes an increase or decrease in the Contractor's cost of, or the time required for the performance of any part of the Work under this contract, whether or not changed by any such order, CMHA shall make an equitable adjustment and modify the Contract in writing.

A. However, except for an adjustment based on defective specifications, no proposal for any change shall be allowed for any costs incurred more than twenty (20) calendar days before the Contractor gives written notice as required.

B. In the case of defective specifications for which CMHA is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specification.

8.2.4. The Contractor must assert its right to an adjustment within thirty (30) calendar days after:

A. Receipt of a written change order, or

B. The furnishing of a written notice by submitting a written statement describing the general nature and the amount of the proposal.

8.2.5. If the facts justify it, CMHA may, in its sole discretion, extend the period for submission.

8.3. Change Order Directive

8.3.1. A Change Order Directive is a written order prepared by CMHA directing a change in the Work and may, if necessary, state a proposed basis for adjustment, if any, of Contract Sum or Contract Time, or both.

8.3.2. A Change Directive shall be used to direct a change in the Work in the absence of a total agreement on the terms of a Change Order and shall only be used in the absence of total agreement on the terms of a Change Order concerning the associated change of the Work.

8.3.3. Upon receipt of a Change Directive, the Contractor shall promptly proceed with the change in the Work involved.

8.3.4. Within fourteen (14) calendar days after receiving the Change Directive, the Contractor shall respond with a Change Order Proposal for adjustment of the Contract Sum or Contract Time or both.

8.3.5. If the Contractor does not respond to the Change Directive as required above, CMHA shall determine the adjustments, if any, of the Contract Sum and Contract Times.

A. If the Contractor does not agree with CMHA's determination, the Contractor shall initiate a claim within ten (10) calendar days of the date on which CMHA issues the determination, and the Contractor's failure to do so shall constitute an irrevocable waiver the Claim.

8.3.6. If CMHA and the Contractor agree on the adjustment of the Contract Sum and/or Contract Time associated with the Change Order Directive, CMHA shall prepare an appropriate Change Order.

8.4. Change Order Procedure

8.4.1. Any Change Order Request must be in writing and submitted by the Contractor to CMHA in accordance with the Notice Provision.

8.4.2. The Contractor's cost of preparing and providing Proposals is included in the Contract Sum.

8.4.3. If CMHA Agrees with Change Order Proposal:

A. CMHA shall prepare each Change Order, attach the supporting documentation, and issue the Change Order to the Contractor for signature.

B. Within three (3) business days after issuance of Change Order to Contractor, Contractor must sign the Change Order and resubmit to CMHA.

C. Change Order is not approved until CMHA's Contracting Officer signs the Change Order.

8.4.4. If CMHA disagrees with Change Order Proposal or Contracting Officer doesn't Approve Change Order:

A. CMHA will notify Contractor in writing with reasons; and

B. Contractor has fourteen (14) calendar days to modify the Change Order Request or invoke ARTICLE XI DISPUTE RESOLUTION/CLAIM PROCEDURE.

8.4.5. Failure to reach an agreement on any proposal shall be a dispute under ARTICLE XI DISPUTE RESOLUTION/CLAIM PROCEDURE herein.

A. Nothing in Change Order Procedure, however, shall excuse the Contractor from proceeding with the contract change pursuant to an issued Change Directive.

8.5. Change Order Proposal

8.5.1. The Contractor's written proposal for equitable adjustment shall be submitted in the form of a lump sum proposal supported with an itemized breakdown of all increases and decreases in the contract in at least the following details:

A. Direct Costs:

i. Materials (list individual items, the quantity and unit cost of each, and the aggregate cost)

ii. Transportation and delivery costs associated with materials

iii. Labor breakdowns by hours or unit costs (identified with specific Work to be performed)

iv. Construction equipment exclusively necessary for the change

v. Costs of preparation and/ or revision to shop drawings resulting from the change

vi. Worker's Compensation and Public Liability Insurance

vii. Employment taxes under FICA and FUTA

viii. Bond Costs

B. Indirect Costs:

i. Indirect costs may include overhead, general and administrative expenses, and fringe benefits not normally treated as direct costs.

C. Profit:

i. The amount of profit shall be negotiated and may vary according to the nature, extent, and complexity of the work required by the change.

ii. The allow-ability of the direct and indirect costs shall be determined in accordance with the Contract Cost Principles and Procedures for Commercial Firms, in effect on the date of this Contract.

iii. The Contractor shall not be allowed a profit on the profit received by any subcontractor.

iv. Equitable adjustments for deleted work shall include a credit for profit and may include a credit for indirect costs.

v. On proposals covering both increases and decreases in the amount of the contract, the application of indirect costs and profit shall be on the net-change in direct costs for the Contractor or subcontractor performing the Work.

8.5.2. The Contractor shall include in the proposal its request for time extension (if any), and shall include sufficient information and dates to demonstrate whether and to what extent the change will delay the completion of the Contract in its entirety.

8.5.3. CMHA shall act on proposals within thirty (30) calendar days after their receipt, or notify the Contractor of the date such action will be taken.

8.5.4. By signing a Change Order, the Contractor irrevocably certifies that the elements of a Change Order described herein are completely satisfied, and waives all rights, if any, to seek further adjustment of the Contract Sum or Contract Times, or both, at a later date with respect to the associated change in the Work, including without limitation on account of the "cumulative impact" of the associated change in the Work in combination with in one or more of the other changes in the Work.

8.5.5. No Proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this Contract.

Except in an emergency endangering life or property, no change shall be made by the Contractor without a prior written authorization from CMHA's Contracting Officer. When the Change Order is signed by the Contractor and CMHA's Contracting Officer, the fully executed Change Order modifies the Contract Documents and authorizes and directs the Contractor to proceed, and the Contractor shall promptly proceed with the associated change in the Work.

8.6. Differing Site Conditions

8.6.1. The Contractor shall promptly, and before the conditions are disturbed, give a written notice to CMHA of:

A. Subsurface or latent physical conditions at the site which differ from those indicated in this contract; or

B. Unknown physical conditions at the site(s), of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the Contract.

i. Written notice of the condition shall be given immediately to CMHA.

C. The Contractor's failure to give notice of the Differing Site Condition as required shall constitute an irrevocable waiver of any associated claim.

8.6.2. CMHA shall investigate the site conditions promptly after receiving the notice.

A. Work shall not proceed at the affected site, except at the Contractor's risk, until the Contracting Officer has provided written instructions to the Contractor.

B. If the conditions do materially so differ and cause an increase or decrease in Contractor's cost of, or the time required for, performing any part of the Work under this Contract, whether or not changed as a result of the conditions, the Contractor shall file a claim in writing to CMHA within ten (10) calendar days after receipt of such instructions and, in any event, before proceeding with the work.

C. An equitable adjustment in the Contract price, the delivery schedule, or both shall be made under this.

8.6.3. No request by Contractor for an equitable adjustment to the Contract under Differing Site Conditions shall be allowed, unless the Contractor has given the written notice required; provided that the time prescribed for giving written notice may be extended by CMHA.

8.6.4. If CMHA determines that the Contractor has not encountered a Differing Site Condition and the Contractor does not agree with that determination, the Contractor must initiate a Claim within ten (10) calendar days of the date that CMHA issues its determination.

8.7. Minor Changes in the Work

8.7.1. CMHA may order minor changes in the Work not involving adjustment of the Contract Sum or extension of the Contract Times and not inconsistent with the intent of the Contract Documents.

A. Those changes shall be effected by written order issued to the Contractor.

8.7.2. The Contractor shall promptly carry out each order for a minor change in the Work if the Contractor agrees that the order does not involve adjustment of the Contract Sum and Contract Times.

8.7.3. If the Contractor reasonably believes that it would be entitled to an adjustment of the Contract Sum or Contract Times, or both, on account of an order for a minor change in the Work, the Contractor, within three (3) business days after receiving the order, shall give CMHA written notice of the Contractor's position, and not proceed with the subject Work without first receiving a Change Order related to it.

8.7.4. The Contractor waives its right to an adjustment of the Contract Sum or Contract Times on account of an order for a minor change in the Work by:

A. Starting the Work that is the subject of the order for a minor change in the Work; or

B. Failing to give the notice described within three (3) business days after receiving the order for a minor change in the Work.

8.8. Change Order Cost or Credit Determination

8.8.1. General

A. The maximum cost or credit resulting from a change in the Work shall be determined as described below.

i. Proposals shall include the information required.

ii. A Unit Price Proposal shall only be valid when incorporated into the Contract by Change Order.

iii. The maximum cost or credit includes all compensation for impact costs.

(a) Additional costs for impacts shall not be allowed.

B. The Contractor shall not assign any portion of the Work to another Person whereby the Contractor would benefit directly or indirectly from the double application of charges for overhead or profit.

C. CMHA may require notarized invoices for material costs and may audit the records of the Contractor and Subcontractors.

D. For each change in the Work, the Contractor shall furnish a detailed Proposal itemized on the Proposal Worksheet Summary Form published by CMHA through which the Contractor shall document the related changes in the Contract Sum.

i. Any Subcontractor pricing shall also be itemized on the Proposal Worksheet Summary Form.

E. Section 8.8.2 Pricing Criteria establishes the exclusive and maximum amount that CMHA shall pay for any Change Order, including, but not limited to, all amounts for interference with, delay, hindrance, disruption, or impact of the Work

i. These Pricing Criteria also govern the value of deduct Change Orders and the Contractor's entitlement to additional compensation or damages through the Claims and dispute resolution processes on account of changes in the Work.

ii. In order to expedite the review and approval process, Proposals shall be prepared in the categories and order listed in - Pricing Criteria**.**

8.8.2. Pricing Criteria

A. Contractor Personnel Costs

i. The Contractor's on-Site management (including supervision and administrative personnel) are not subject to State or Federal Prevailing Wage Rates.

ii. These costs will be calculated on an hourly basis according to the rates acceptable to CMHA.

iii. In no event will the Contractor be entitled to an increase in the Contract Sum on account of Contractor Personnel Costs unless the Contractor actually incurs additional Contractor Personnel Costs solely on account of the associated change in the Work.

B. Labor

i. Field labor directly involved in the Work based upon the actual rate of pay to the worker.

ii. If the Project is subject to payment of prevailing wage rates, field labor shall be paid according to the applicable classification of labor as established in the applicable prevailing wage determination.

iii. In no event will the Contractor be entitled to an increase in the Contract Sum on account of labor costs unless the Contractor actually incurs additional labor costs solely on account of the associated change in the Work.

iv. Under no conditions will the increase exceed those additional labor costs the Contractor actually incurs.

v. The cost for supervision above the level of working forepersons (such as general forepersons, superintendent, project manager, etc.) is included in the adjustment Contractor Personnel Costs.

C. Fringes

i. Fringe benefit credit for labor is only allowable for prevailing wage fringe benefits including, but not limited to, Health and Welfare, vacation, apprenticeship training, and certain types of pension plans.

ii. Each fringe benefit for which credit is requested shall be calculated on an hourly basis and listed as a separate line item.

iii. The Contractor shall submit documentation supporting the calculation of the amounts for each fringe benefit for each worker classification, including labor provided by Subcontractors.

D. Allowable Payroll Expenses

i. Allowable payroll expenses for labor including payroll taxes as well as other benefits that are required by Applicable Law, shall each be a separate line item.

E. Equipment Rentals

i. All charges for certain non-owned heavy or specialized equipment at up to 100 percent of the documented rental cost

ii. No rental charges shall be allowed for hand tools, minor equipment, simple scaffolds, etc. Downtime due to repairs, maintenance and weather delays shall not be allowed.

iii. Contractor shall submit copies of actual paid invoices to substantiate rental costs.

F. Owned Equipment

i. All charges for certain heavy or specialized equipment owned by the Contractor or Subcontractor performing the Work at up to 100 percent of the cost listed by the current edition of the Associated Equipment Distributors' *AED Green Book* heavy equipment rental rates.

ii. No recovery shall be allowed for hand tools, minor equipment, simple scaffolds, etc.

iii. The longest period of time that the equipment is to be required for the Work shall be the basis for the pricing.

iv. Downtime due to repairs, maintenance, and weather delays shall not be allowed.

G. Trucking

i. A reasonable delivery charge or per-mile trucking charge for delivery of required materials or equipment

ii. Charges for use of a pick-up truck shall not be allowed.

H. Materials

i. The actual cost (including all discounts, rebates or related credits) of all materials incorporated into the changed Work

ii. Documentation shall show costs, quantities, or Unit Prices of all items, as appropriate.

iii. The cost or credit for reusable materials shall be limited to 33 percent of the material cost for each use.

I. Contractor's General Conditions Costs

i. The Contractor's General Conditions Costs to the extent attributable to an associated change in the Contract Time for achievement of Final Acceptance resulting from the change in Work

ii. In no event shall the Contract Sum adjustment per day of Contract Time adjustment exceed an amount equal to **(1)** the sum of the General Conditions Costs line items in the Contractor's Schedule of Values approved by CMHA, **(2)** divided by the total number of days of the original Contract Time for achievement of Final Acceptance.

iii. The Contractor shall:

(a) Exclude the bond premium from the Schedule of Values for the purposes of the calculation; and

(b) Include the actual adjustment of the Bond Premium attributable to an associated change in the Contract Sum.

iv. If the Contractor purchases Builder's Risk insurance for the Project, the Contract shall:

(a) Exclude the Builder's Risk insurance premium from the Schedule of Values for the purposes of the calculation; and

(b) Include the actual adjustment of the Builder's Risk insurance premium attributable to an associated change in the Contract Sum.

J. Subcontractor Overhead and Profit

i. Adjustment of the Contract Sum on account of a change in Subcontractor-performed Work shall include the Subcontractor's aggregate overhead and profit allowance equal to 15 percent of the sum of the Subcontractor's costs that are associated with that changed Work.

ii. The allowance applies to each Subcontractor tier.

iii. The allowance covers:

(a) The costs required to schedule and coordinate the Work
(b) Telephone
(c) Telephone charges
(d) Facsimile
(e) Telegrams
(f) Postage
(g) Photos
(h) Photocopying
(i) Hand tools
(j) Simple scaffolds (one level high)
(k) Tool breakage
(l) Tool repairs
(m) Tool replacement
(n) Tool blades
(o) Tool bits
(p) Home office estimating and expediting
(q) Home office clerical and accounting support
(r) Home office labor (management, supervision, engineering)
(s) All other home office expense, legal services, travel, and parking expenses

iv. An exception is allowed for shop or engineering labor, which shall not be subject to Prevailing Wage rates for steel fabricators, sheet metal fabricators, and sprinkler system fabricators performing work off-site.

(a) Recovery for these matters shall be allowed on an hourly basis.

v. An exception is allowed for field supervision labor, for those portions of the Change Order Work that will be performed, or was performed, at times when the superintendent is not required to be on site, including but not limited to overtime hours due to acceleration and\ extensions of the Contract Times.

(a) Recovery for this matter will be allowed on an hourly basis.

K. Contractor's Fee

i. Adjustment of the Contract Sum on account of a change in the Work shall include an allowance for the Contractor's Fee equal to 10 percent of the sum of the costs that are associated with that changed Work.

L. Miscellaneous

i. Adjustment of the Contract Sum on account of a change in Work may include the following costs with no allowance for Contractor's Fee or Subcontractor overhead and profit.

ii. The premium portion only for approved overtime (labor and fringes)

iii. The straight time portion is included.

8.8.3. Costs that shall not be reimbursed for Change Order Work include the following

A. Voluntary employee deductions including, but not limited to, deductions for charitable donations or U.S. savings bonds

B. Employee profit sharing

8.9. Time Extension

8.9.1. Every adjustment of the Contract Times associated with any change in the Work shall be determined as provided herein, which establishes the Contractor's maximum entitlement for any change in the Work, including without limitation all adjustments for interference, delay, hindrance, or disruption of the Work.

8.9.2. This also governs time adjustments for deduct Change Orders and the Contractor's entitlement to additional time through the claims and dispute resolution processes on account of changes in the Work.

8.9.3. The Contractor shall substantiate all changes in the Contract Times with:

A. A written description of the nature of the interference, disruption, hindrance or delay;

B. Identification of Persons and events responsible for the interference, disruption, hindrance or delay;

C. Date, or anticipated date, of commencement of the interference, disruption, hindrance or delay;

D. Identification of activities by schedule activity number and name on the Construction Progress Schedule, which may be affected by the interference, disruption, hindrance or delay, or new activities created by the interference, disruption, hindrance or delay and the relationship with existing activities;

E. Anticipated duration of the interference, disruption, hindrance or delay and of any remobilization period;

F. Specific number of days of extension requested and specific number of days for remobilization requested;

G. Recommended action to avoid or minimize any future interference, disruption, hindrance or delay; and

H. A detailed written proposal for an increase in the Contract Sum which would fully compensate the Contractor for all costs of acceleration of the Work needed to completely overcome the associated delay, if any.

8.9.4. A Change Order may authorize extension of the Contract Time for specific elements, while maintaining milestone dates for unaffected elements.

A. Such a Change Order may also authorize an appropriate adjustment to Liquidated Damages.

8.9.5. Critical Path

A. Time extensions shall depend upon the extent to which the Work on the critical path of the Construction Progress Schedule is affected.

8.9.6. A Change Order granting a time extension may provide that the Contract Times shall be extended for only elements so interfered with, disrupted, hindered, or delayed and related remobilization and that shall not be altered and may further provide for adjustment of Liquidated Damages.

9. ARTICLE IX CONSTRUCTION CLOSEOUT

9.1. Final Cleaning

9.1.1. Before requesting the Substantial Completion inspection of the Work, the Contractor shall clean the Site, remove waste materials and rubbish attributable to the Project, and restore the property to an acceptable condition so that upon Substantial Completion, the premises are ready for occupancy by CMHA.

9.1.2. If the Contractor performs any Work after final cleaning, the Contractor shall clean the affected area as provided above so that upon Substantial Completion, the premises are ready for occupancy by CMHA.

9.1.3. Final cleaning shall be done to the reasonable satisfaction of CMHA.

9.2. Inspection and Construction of the Work

9.2.1. The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the Contract conforms to contract requirements.

A. All work is subject to CMHA inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the Contract.

9.2.2. CMHA inspections and tests are for the sole benefit of CMHA and do not:

A. Relieve the Contractor of responsibility for providing adequate quality control measures;

B. Relieve the Contractor of responsibility for loss or damage of the material before acceptance;

C. Constitute or imply acceptance; or

D. Affect the continuing rights of CMHA after acceptance of the completed work.

9.2.3. The presence or absence of the CMHA inspector does not relieve the Contractor from any Contract requirement, nor is the inspector authorized to change any term or condition of the specifications without the Contracting Officer's written authorization.

A. All instructions and approvals with respect to the work shall be given to the Contractor by CMHA.

9.2.4. The Contractor shall promptly furnish, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by CMHA.

A. CMHA may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary.

B. CMHA shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size and performance tests shall be performed as described in the Contract.

9.3. Routine Inspections

9.3.1. CMHA may conduct routine inspections of the construction Site on a daily basis.

9.3.2. The Contractor shall, without charge, replace or correct Work found by CMHA not to conform to contract requirements, unless Contracting Officer decides that it is in its interest to accept the Work with an appropriate adjustment in Contract Sum.

A. The Contractor shall promptly segregate and remove rejected material from the premises.

9.3.3. If the Contractor does not promptly replace or correct rejected Work, CMHA may:

A. By Contract or otherwise, replace or correct the Work and charge the cost to the Contractor; or

B. Terminate for default the Contractor's right to proceed.

9.3.4. If any work requiring inspection is covered up without approval of CMHA, it must, if requested by the Contracting Officer, be uncovered at the expense of the Contractor.

A. If at any time before final acceptance of the entire work, CMHA considers it necessary or advisable, to examine work already completed by removing or tearing it out, the Contractor, shall on request, promptly furnish all necessary facilities, labor, and material.

B. If such Work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray all the expenses of the examination and of satisfactory reconstruction.

C. If, however, such work is found to meet the requirements of the Contract, the Contracting Officer shall make an equitable adjustment to cover the cost of the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

9.4. Substantial Completion

9.4.1. Contractor's Punch List

A. When the Contractor considers the Work, or a designated portion thereof, Substantially Complete the Contractor shall inspect the Work and prepare a list of Defective Work and incomplete or unacceptable Work ("Contractor's Punch List").

B. The Contractor shall list all items of Work not in compliance with the Contract Documents, including items the Contractor is requesting to be deferred.

i. The Contractor shall proceed to correct all items listed on the Contractor's Punch List and certify that the incomplete items listed on the Contractor's Punch List are to its knowledge an accurate and complete list by signing the Contractor's Punch List.

ii. The Contractor's failure to include an item on the Contractor's Punch List shall not alter the Contractor's responsibility to complete the Work in accordance with the Contract Documents.

iii. The Contractor shall submit the signed Contractor's Punch List to CMHA together with a request for a Substantial Completion inspection of the Work.

9.4.2. Substantial Completion Inspection

A. The Contractor shall notify CMHA, in writing, as to the date when in its opinion all or a designated portion of the Work will be substantially completed and ready for inspection.

i. If CMHA and/or the A/E determine that the state of preparedness is as represented, CMHA will promptly arrange for the inspection.

ii. Unless otherwise specified in the Contract, CMHA shall accept, as soon as practicable after completion and inspection, all work required by the Contract or that portion of the Work that CMHA determines and designates can be accepted separately.

iii. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or CMHA's right under any warranty or guarantee.

B. Within three (3) business days after receipt of the request for the Substantial Completion inspection of the Work, CMHA shall notify the Contractor of acceptance or rejection of the request, stating reasons for any rejection.

i. Within seven (7) calendar days after its acceptance of the Contractor's request, CMHA and/or the A/E shall conduct the Substantial Completion inspection to determine whether the Work, or designated portion, is in conformity with the Contract Documents and Substantially Complete.

ii. If CMHA and/or the A/E determines that the Work is Substantially Complete, within three (3) business days after the Substantial Completion inspection, CMHA and/or the A/E shall prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion and include a list of Defective, incomplete, or unacceptable Work ("CMHA's Punch List").

iii. CMHA's Punch List shall include:

(a) The items on the Contractor's Punch List that are not yet completed or corrected as of the date of the Substantial Completion inspection; and

(b) Comments from CMHA regarding the Punch List and other issues related to the Project.

iv. CMHA shall submit the Certificate of Substantial Completion to the Contractor for their written acceptance.

(a) Upon their acceptance and consent of the Contractor's Surety, and subject to CMHA's right to withhold payment, CMHA shall release retainage.

v. CMHA and/or the A/E's failure to include an item on CMHA's Punch List shall not alter the Contractor's responsibility to complete the Work in accordance with the Contract Documents.

vi. If CMHA subsequently determines that the Work is not Substantially Complete, CMHA may request compensation for related expenses.

(a) CMHA may deduct the additional expenses from payments then or thereafter due the Contractor.

(b) If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to CMHA. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, (whether alleged or proven), demands, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, associated with the failure of the Contractor to timely and properly complete the Punch List items.

9.4.3. Completion of Punch List Items

A. The Contractor shall complete all items on the CMHA's Punch List prior to date forContract Completion.

B. After completing all items on the CMHA's Punch List, the Contractor shall provide a written request for Final Inspection of the Work.

i. If Work on the Punch List cannot be timely completed, the Contractor shall submit a change order request MODIFICATIONS.

ii. Within three (3) business days after receipt of the request for the Final Inspection of the Work, CMHA and/or the A/E shall complete a Final Inspection of the Work for compliance with the Contract Documents.

iii. If multiple inspections of items on CMHA's Punch List are required due to the Contractor's failure to properly and timely complete them, the Contractor shall pay any additional costs incurred by the A/E and CMHA resulting from any attendant delay.

(a) CMHA may deduct those additional costs from payments then or thereafter due the Contractor.

(b) If payments then or thereafter due the Contractor are not sufficient to cover those amounts, the Contractor shall immediately pay the amount of the insufficiency to CMHA. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, (whether alleged or proven), demands, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, related to multiple inspections by CMHA of items on the Punch List due to the Contractor's failure to properly and timely complete the Punch List.

9.5. Demonstration and Training, Operating Appurtenances

9.5.1. The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall perform demonstration and training of CMHA's maintenance personnel as specified in the Contract Documents.

9.5.2. The Contractor, as a condition precedent to execution of the Certificate of Contract Completion and final payment, shall organize and submit operating appurtenances and loose items related to operation and maintenance of the completed Project to CMHA, including, but not limited to:

A. Keys to door and window hardware, panels, and other devices not directly provided to CMHA from the manufacturer;

B. Operating handles, levers, cranks, specialized wrenches or drivers, remote controls, and similar items; and

C. Extra materials (e.g., attic stock).

9.6. Acceptance of Defective Work

9.6.1. Defective Work may only be knowingly accept by CMHA in writing instead of CMHA requiring its removal or correction, in which case the Contract Sum must be equitably reduced to account for the reduction in benefit of the Work received by CMHA on account of the Defective Work.

A. CMHA may only accept Defective Work though a deduct Change Order that makes explicit reference to Acceptance of Defective Work

9.6.2. None of the following will constitute acceptance of Defective Work, a release of the Contractor's obligation to perform the Work in accordance with the Contract, or a waiver of any rights set forth in the Contract or otherwise provided by Applicable Law:

A. Observations or inspections by CMHA or the A/E;
B. The making of any payment;
C. Substantial Completion or the issuance of a Certificate of Substantial Completion;
D. Partial Occupancy and CMHA's use or occupancy of the Work or any part of it;
E. Contract Completion or the issuance of a partial or final Certificate of Contract Completion;
F. Any review or approval of a submittal;
G. Any inspection, test, or approval by other Persons; or
H. Any correction of Defective Work by CMHA.

9.7. Building Commissioning

9.7.1. If the Project scope includes building commissioning, the Contractor shall participate in the Commissioning Process, as prescribed in the Contract Documents.

9.7.2. The Contractor shall permit the A/E, CMHA, or a third-party Commissioning Agent ("CxA") if applicable, access to commission performance based equipment, fixtures, and/or systems (e.g., HVAC, fire protection, smoke evacuation, fume hoods, emergency power, etc.), prior to Substantial Completion.

9.7.3. The A/E, CMHA, or CxA if applicable, shall promptly notify, in writing, the Contractor of any deficiency identified during the Commissioning Process.

9.7.4. To facilitate the Commissioning Process, the Contractor shall submit 4 sets of Operation and Maintenance manuals for dynamic and engineered systems to CMHA and CxA, if applicable, for approval. This submission shall occur within 30 days of obtaining approval of all related Contractor submittals required by the Contract Documents.

9.8. Contract Completion

9.8.1. Partial Contract Completion

A. When items of Work cannot be completed until a subsequent date, CMHA shall prepare a partial Certificate of Contract Completion that shall include a detailed list of the deferred Work and the date(s) by which the Contractor will complete that Work.
B. CMHA shall submit the partial Certificate of Contract Completion to Contractor for their written acceptance. Upon their acceptance of the partial Certificate of Contract Completion and consent of the Contractor's Surety, CMHA may release payment to the Contractor, as determined in the sole discretion of CMHA.

9.8.2. Final Contract Completion

A. Contract Completion shall occur no later than 30 calendar days from the date of Substantial Completion.
B. When all items on CMHA's Punch List have been completed to the satisfaction of CMHA, all requirements of the Contract Documents have been completed, and the provisions have been fulfilled, CMHA shall prepare and recommend execution of final Contract payment.
C. The date that CMHA executes the final Certificate of Contract Completion or issues Contract payment, whichever is later, is the date of Contract Completion.
D. Nothing in Contract Completion shall constitute a waiver of CMHA's ability to pursue damages as the result of any breach of the Contract by the Contractor or Liquidated Damages.

10. ARTICLE X SUSPENSION AND TERMINATION

10.1. Suspension of the Work

10.1.1. The Contracting Officer may order the Contractor in writing to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of CMHA.

10.1.2. If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of CMHA in the administration of this Contract, or by CMHA's failure to act within the time specified (or within a reasonable time if not specified) in this Contract, an adjustment shall be made for any increase in the cost of performance of the Contract (excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the Contract modified in writing accordingly.

A. However, no adjustment shall be made for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor or for which any equitable adjustment is provided for or excluded under any other provision of this Contract.

10.1.3. A Claim shall not be allowed:

A. For any costs incurred more than twenty (20) calendar days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order); and

B. Unless the Claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but no later than the date of final payment under the Contract.

10.1.4. If CMHA suspends the Work under ARTICLE X SUSPENSION AND TERMINATION and the Contractor submits a proper Payment Request, subject to all other provisions of the Contract Documents, the Contractor shall be entitled to payment of compensation due under the Contract Documents for the Work performed before the suspension based upon the Schedule of Values.

10.1.5. CMHA, without prejudice to any other right or remedy it may have, may order the Contractor in writing to suspend, delay, or interrupt the performance of the Work in whole or in part for such period as CMHA may determine for any of the following reasons:

A. Defective Work;

B. The Contractor is causing undue risk of damage to any part of the Project or adjacent area;

C. The Contractor fails to furnish or perform the Work in such a way that the complete Work will conform to the requirements of the Contract Documents; or

D. Any other cause CMHA reasonably believes justifies suspension.

i. CMHA's exercise of its right to suspend the Work shall not entitle Contractor to any adjustment of the Contract Sum, Contract Time or both.

10.1.6. Upon receipt of the notice of suspension, the Contractor shall cease Work on the suspended activities and take all necessary or appropriate steps to limit disbursements and minimize respective costs.

A. The Contractor shall furnish a report to CMHA within five (5) business days of receiving the notice of suspension, describing the status of the Work, including, but not limited to, results accomplished, resulting conclusions, and other information as CMHA may require.

10.1.7. CMHA's right to stop the Work shall not give rise to any duty to exercise the right for the benefit of the Contractor or any other party, and CMHA's exercise or failure to exercise the right shall not prejudice any of CMHA's other rights including the right to suspend the Work in the future under the same or similar circumstances.

10.2. Termination for Convenience

10.2.1. CMHA, through the Contracting Officer, may terminate this contract in whole, or in part, whenever the Contracting Officer determines that such termination is in the best interest of CMHA.

A. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which the performance of the work under the contract is terminated, and the date upon which termination becomes effective.

10.2.2. Upon delivery of the notice of termination for convenience, the Contractor shall immediately proceed with performance of the following duties in accordance with instructions from CMHA:

- **A.** Cease operations as specified in the notice;
- **B.** Place no further orders and enter into no further subcontracts for materials, labor, services, or facilities, except as necessary to complete continued portions of the Project;
- **C.** Terminate all subcontracts and orders to the extent they are related to the Work terminated;
- **D.** Proceed with Work not terminated; and
- **E.** Take actions that may be necessary, or that CMHA may direct, for the protection and preservation of the terminated Work.
  - **i.** Failure to do so may lead to Contractor's liability for actual damages as a result of Contractor's failure to protect the Work.

10.2.3. If the performance of the work is terminated, either in whole or in part, CMHA shall be liable to the Contractor for reasonable and proper costs resulting from such termination upon the receipt by CMHA of a properly presented claim setting out in detail:

- **A.** The total cost of the work performed to date of termination less the total amount of contract payments made to the Contractor;
- **B.** The cost of settling and paying claims under Subcontracts and material orders for work performed and materials and supplies delivered to the site, payment for which has not been made by CMHA to the Contractor or by the Contractor to the Subcontractor or supplier;
- **C.** The cost of preserving and protecting the work already performed until CMHA or assignee takes possession thereof or assumes responsibility therefore; and
- **D.** An amount constituting a reasonable profit on the value of the work performed by the Contractor.

10.2.4. CMHA will act on the Contractor's claim within sixty (60) calendar days (unless CMHA deems in writing that additional time is needed for review) of receipt of the Contractor's claim.

10.2.5. Any disputes are expressly made subject to the provisions of this Contract.

10.2.6. If CMHA terminates the Work the termination shall not affect the rights or remedies of CMHA against the Contractor then existing or which may thereafter accrue.

10.2.7. Notwithstanding, if CMHA terminates the Work but there exists an event of Contractor's default, the Contractor shall be entitled to receive only such amounts as it would be entitled to receive following the occurrence of an event of default as provided for below.

10.3. Termination for Cause/Default

10.3.1. If the Contractor materially breaches this Contract, including without limitation, the Contractor refuses or fails to prosecute the work, or any separable part thereof, with the diligence that will insure its completion within the time specified in this Contract, or any extension thereof, or fails to complete said work within this time, CMHA may, by written notice to the Contractor, terminate the right to proceed with the work (or separable part of the work) that has been delayed.

A. In this event, CMHA may take over the work and complete it, by contract or otherwise, and may take possession of and use any materials, equipment, and plant on the work site necessary for completing the work.

B. The Contractor and its sureties shall be liable for any damage to CMHA resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated.

i. This liability includes any increased costs incurred by CMHA in completing the Work.

C. Other examples of material breaches of the Contract include but are not limited to:

i. Refusal to remedy defective work;

ii. Failure to supply enough properly skilled workers or proper materials;

iii. Failure to provide revised Construction Progress Schedule or Recovery Plan;

iv. Failure to properly make payment to Subcontractors or Consultants; or

v. Disregarding laws, ordinances, or rules, regulations, or orders of a public authority with jurisdiction over the Project.

10.3.2. If CMHA intends to exercise its termination right, CMHA shall issue not less than five (5) business days written notice to the Contractor and the Contractor's Surety in accordance with ORC.

A. Notwithstanding any provision of the Contract to the contrary, the issuance of a 3-Day Notice is not a condition precedent to CMHA's exercise of its rights and CMHA's decision to not issue a 3-Day Notice will not prejudice CMHA's rights under this.

10.3.3. If the Contractor fails to satisfy the requirements set forth in the 5-Day Notice within fifteen (15) calendar days of receipt of the 5-Day Notice or as otherwise specified in the notice, CMHA may declare the Contractor in default, terminate the Contract, and employ upon the Work the additional force or supply materials or either as appropriate, and remove Defective Work.

10.3.4. If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the Parties will be the same as if the termination had been for convenience of CMHA.

10.3.5. If the Contract is terminated, the Contractor's Surety may perform the Contract.

A. If the Contractor's Surety does not commence performance of the Contract within ten (10) calendar days of the date of Contract termination, CMHA may complete the Work by means that CMHA deems appropriate.

i. CMHA may take possession of and use all materials, facilities, and equipment at the Site or stored off-site, for which CMHA has paid.

B. If CMHA notifies the Contractor's surety that the Contractor is in default or terminates the Contract, the surety will promptly and in not less than twenty-one (21) calendar days investigate the claimed material default or termination.

i. If CMHA gives a notice of default and then terminates the Contract, the surety shall complete its investigation within twenty-one (21) calendar days of the notice of default.

(a) As part of such investigation, the surety shall visit the offices of the Contractor, A/E and CMHA to review the available project records.

ii. If the surety proposes to take over the Work, the surety shall do so no later than the expiration of such 21-day period or ten (10) calendar days after the date CMHA terminates the Contract, whichever is later.

iii. If CMHA terminates the Work, and the surety proposes to provide a replacement contractor, the replacement contractor shall be fully capable of performing the Work in accordance with the Contract Documents, including meeting all the requirements of the Contract Documents.

(a) If the Contractor is terminated, the replacement contractor shall not be the Contractor.

iv. The surety will provide the Owner with the results of its investigation, including any written report or documents.

C. Termination for Cause/Default is in addition to CHMA's other rights under the Contract Documents and is not intended to create any rights of the surety, including but not limited to the right to take over the Contractor's obligations.

10.3.6. If the Contract is terminated for cause, the Contractor shall not be entitled to further payment.

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, (whether alleged or proven), demands, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, arising out of or related the costs incurred by CMHA to finish the Work following termination of the Contractor for cause.

B. If the unpaid balance of the Contract Sum exceeds the costs of finishing the Work, including without limitation the fees and charges of engineers, architects, attorneys, and other professionals and court costs, and other damages incurred by CMHA and not expressly waived, the Contractor or Surety shall immediately pay the amount of insufficiency to CMHA.

C. This obligation for payment shall survive termination of the Contract.

10.3.7. If the Contractor's Surety performs the Work, the provisions of the Contract Documents govern the Surety's performance, with the Surety in place of Contractor in all provisions including, but not limited to, provisions for payment for the Work, and provisions of the right of CMHA to complete the Work.

10.3.8. If CMHA terminates the Contract, the termination shall not affect any rights or remedies of CMHA against the Contractor then existing or which may thereafter accrue.

A. CMHA's retention or payment of funds due to the Contractor shall not release the Contractor or the Contractor's Surety from liability for performance of the Work in accordance with the Contract Documents.

10.4. Contractor Insolvency

10.4.1. Bankruptcy of Contractor

A. If the Contractor files a voluntary petition in bankruptcy or has an involuntary petition in bankruptcy filed against it, the Contractor, the Contractor as the debtor-in-possession, or the trustee of the Contractor's bankruptcy estate shall notify CMHA in writing within five (5) days of such filing and file a motion to assume or reject the Contract within twenty (20) calendar days after the filing of the petition and shall diligently prosecute that motion to conclusion so as to obtain an order granting or denying that motion within forty-five (45) calendar days after the filing of the petition.

B. The failure of the Contractor to file and prosecute that motion Contractor shall constitute a material breach of the Contract by the Contractor as time is of the essence with respect to Contractor's performance of all terms of this Contract.

C. The Contractor agrees to the granting of relief from the automatic stay of the Bankruptcy Code, to permit CMHA to terminate the Contract for cause in such instance and issue and serve all notices necessary to terminate the Contract or arising out of termination of the Contract and to take any other action necessary to terminate the Contract.

10.4.2. Receivership or Assignment for the Benefit of Creditors

A. If the Contractor makes a general assignment for the benefit of creditors or if a receiver is appointed for all or a substantial part of Contractor's business or property, CMHA shall serve written notice to the Contractor and Contractor's Surety stating that any failure of the Contractor to provide adequate assurance of continued performance shall be considered a rejection of the Contract, which shall result in termination of the Contract for cause.

B. Termination of the Contract need not be evidenced by an order of any court.

11. ARTICLE XI DISPUTE RESOLUTION/CLAIM PROCEDURE

11.1. General

11.1.1. "Claim," as used in ARTICLE XI DISPUTE RESOLUTION/CLAIM PROCEDURE, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, additional time, the adjustment or interpretation of contract terms, or other relief arising under or relating to the contract.

11.1.2. A Claim arising under the Contract, unlike a claim relating to the contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant.

11.1.3. A voucher, invoice, application for payment, or other routine request for payment that is permitted under the Contract Documents and is not in dispute when submitted, is not a Claim.

11.1.4. The submission may be converted to a Claim by complying with the requirements of ARTICLE XI DISPUTE RESOLUTION/CLAIM PROCEDURE, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

11.1.5. Except for disputes arising under ARTICLE XIX LABOR STANDARDS, herein, all disputes arising under or relating to this contract, including any claims for damages for the alleged breach thereof which are not disposed of by agreement, shall be resolved under ARTICLE XI DISPUTE RESOLUTION/CLAIM PROCEDURE.

11.1.6. All Claims by the Contractor shall be made in writing and submitted to CMHA for a written decision.

A. A claim by CMHA against the Contractor shall be subject to a written decision by the Contracting Officer.

11.2. Initiation of a Claim

11.2.1. Every Claim shall accrue upon the date of occurrence of the event giving rise to the Claim.

11.2.2. Except as provided, the Contractor shall initiate every Claim by giving written notice of the Claim to CMHA within ten (10) calendar days after occurrence of the event giving rise to the Claim, with the following exceptions:

A. The 10-day time limit on initiating a Claim arising from the response of an RFI by CMHA begins to run on the date of the response.

B. The 10-day time limit on initiating a Claim arising from CMHA's determination concerning a Differing Site Condition begins to run on the date of the determination .

11.2.3. The Contractor's written notice of a Claim shall provide the following information:

A. Nature and anticipated amount of the impact, including all costs for any interference, disruption, hindrance, or delay, which shall be calculated and be a fair and reasonably accurate assessment of the damages suffered or anticipated by the Contractor;

B. Identification of the circumstances responsible for causing the impact, including, but not limited to, the date or anticipated date, of the commencement of any interference, disruption, hindrance, or delay;

C. Identification of activities on the Construction Progress Schedule that will be affected by the impact or new activities that may be created and the relationship with existing activities;

D. Anticipated impacts and anticipated duration of any interference, disruption, hindrance, delay, or impact, and any remobilization period; and

E. Recommended action to avoid or minimize any interference, disruption, hindrance, delay, or impact.

11.2.4. The Contractor's failure to initiate a Claim as and when required shall constitute the Contractor's irrevocable waiver of the Claim.

11.3. Substantiation of Claims General

11.3.1. Within thirty (30) calendar days after the initiation of a Claim, the Contractor shall submit three (3) copies of all information and statements required to substantiate a Claim and all other information that the Contractor believes substantiates the Claim.

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11.3.2. The Contractor shall substantiate all of its Claims by providing the following minimum information:

A. A narrative of the circumstances, which gave rise to the Claim, including without limitation the start date of the event or events and the actual or anticipated finish date;

B. Detailed identification of the Work affected by the event giving rise to the Claim;

C. Copies of the Contractor's daily log for each day of impact;

D. Copies of relevant correspondence and other information regarding or supporting Contractor's entitlement;

E. Copies of any and all information related to the Contractor's costs, including all job cost reports, bid take offs, and other financial information related to the Contractor's Claim;

F. The notarized Certification of a Claim

11.4. Substantiation of Claims for increase of the Contract Sum

11.4.1. In addition to the minimum information required by Contractor, the Contractor shall substantiate each Claim for an increase of the Contract Sum with:

A. Written documentation of the actual additional direct and indirect costs to the Contractor due to the event giving rise to the Claim;

B. A written statement from the Contractor that the increase requested is the entire increase in the Contract Sum associated with the Claim; and

C. The general substantiation documentation.

11.5. Substantiation of Claims for Extension of the Contract Time

11.5.1. In addition to the minimum information required by Contractor, the Contractor shall substantiate each Claim for an extension of the Contract Times with:

A. Written documentation of the actual delay to the critical path of the Construction Progress Schedule due to the event giving rise to the Claim;

B. A detailed written Proposal for an increase in the Contract Sum that would fully compensate the Contractor for all costs of acceleration of the Work needed to completely overcome the associated delay, A written statement from the Contractor that the extension requested is the entire extension of the Contract Times associated with the Claim; and

D. The general substantiating documentation.

11.5.2. In addition, if adverse weather conditions are the basis for a Claim for additional time, the Contractor shall document the Claim with data substantiating that weather conditions were abnormal for the period, could not have been reasonably anticipated, and had an adverse effect on a critical element of the scheduled construction.

11.6. Certification of a Claim

11.6.1. The Contractor shall certify each Claim within thirty (30) calendar days after initiating the Claim or before Contract Completion, whichever is earlier, by providing the notarized Certification of a Claim specified below, signed and dated by the Contractor:

A. *"The undersigned Contractor certifies that the Claim is made in good faith; that the supporting data is accurate and complete to the best of the Contractor's knowledge and belief; that the amount requested is a fair, reasonable, and necessary adjustment for which the Contractor believes that CMHA is liable; and that the undersigned is duly authorized to certify the Claim on behalf of the Contractor."*

11.7. Delay and Delay Damage Limitations

11.7.1. Subject to other provisions of the Contract, the Contractor will be entitled to an extension of the Contract Times on account of delay in the commencement or progress of Work on the critical path of the Construction Progress Schedule caused by acts of unforeseeable Nature or the public enemy, acts of the government not arising from the Contractor's failure to comply with Applicable Law, fires, floods, epidemics, weather, and labor disputes beyond the Contractor's control.

11.7.2. Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum, or an extension of the Contract Times, or both:

A. On account of the impact of any normal adverse weather on any of the Work or on account of the impact of any abnormal adverse weather on Work not on the critical path;

B. To the extent that a delay occurs concurrently with a delay attributable to the Contractor; or

C. On account of the delay of any Work not on the critical path.

i. When the Contractor is prevented from completing any part of the Work on the critical path within the Contract Time due to weather conditions, provided the Contractor properly initiates a Claim, the Contract Time will be extended by one (1) day for each work day lost due to weather that delays Work on the critical path in excess of those in the following table:

Month	Number of Workdays Lost Due To Weather
January	8
February	8
March	7
April	6
May	5
June	4
July	4
August	4
September	5
October	6
November	6
December	6

11.7.3. Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum or any type of damages on account of a delay in the commencement or progress of Work on the critical path unless:

A. The delay is caused by CMHA; and

B. The delay was not authorized or permitted under the Contract.

11.7.4. Notwithstanding any other provision of the Contract Documents to the contrary, the Contractor shall not be entitled to an increase in the Contract Sum or any type of damages arising from a delay in the commencement or progress of any the Work caused by the occurrence or non-occurrence of an event beyond CMHA's control such as acts of Nature or the public enemy, acts of the government, fires, floods, epidemics, labor disputes, unusual delivery delays, weather, or damages caused by the Contractor.

11.8. Derivative Claims

11.8.1. Notwithstanding any other provision of the Contract to the contrary, if CMHA prosecutes a claim, suit, or appeal against a Separate Consultant or Separate Contractor to recover damages the Contractor suffers on account of the acts or neglects of a Separate Consultant or Separate Contractor or person or entity for whom either is legally responsible, CMHA's liability to the Contractor shall not exceed the amount CMHA actually recovers from the Separate Consultant or Separate Contractor on account of those damages less the costs CMHA incurs recovering them. CMHA is not obligated to prosecute any such claim, suit, or appeal.

11.9. Claim Decision

11.9.1. CMHA shall, within sixty (60) calendar days (unless otherwise requested), decide Claims submitted by Contractor or notify the Contractor of the date by which the decision will be made.

11.9.2. The Contracting Officer's decision shall be final with respect to Claims by Contractor unless the Contractor:

A. Appeals in writing to a higher level at CMHA in accordance with the CMHA's policy and procedures;

B. Refers the appeal to an independent mediator or arbitrator; or

C. Files suit in a court of competent jurisdiction. Such suit must be filed within fifteen (15) calendar days (unless a different time period is identified in the Claim Decision) after receipt of CMHA's decision.

11.9.3. The Contractor shall proceed diligently with performance of this Contract, pending final resolution of any request for relief, Claim, appeal, or action arising under or relating to the Contract, and comply with any decision of CMHA.

11.10. Audit of a Claim

11.10.1. All Claims submitted by Contractor shall be subject to audit at any time following filing of the Claim by Contractor, whether or not the Claim is part of any lawsuit.

11.10.2. The audit may be performed by employees of CMHA or by a consultant engaged by CMHA.

11.10.3. The audit may begin upon 10-days' notice to the affected Contractor or affected Subcontractor.

11.10.4. The Contractor shall cooperate with the request.

11.10.5. **Failure of the Contractor or Subcontractor to produce sufficient records to allow CMHA to audit and verify a Claim shall constitute an irrevocable waiver of the Claim or portion of the Claim that could not be completely audited.**

11.10.6. The Contractor shall make available to CMHA all Contractor and Subcontractor documents related to the Claim including, without limitation, the following documents:

- **A.** Daily time sheets and superintendent's daily reports;
- **B.** Union agreements, if any, and employer agreements;
- **C.** Insurance, welfare, fringes, and benefits records;
- **D.** Payroll tax returns;
- **E.** Material invoices, purchase orders, Subcontracts, and all material and supply acquisition contracts;
- **F.** Material cost distribution worksheets;
- **G.** Equipment records (list of Contractor equipment, rates, etc.);
- **H.** Vendor rental agreements and Subcontractor invoices;
- **I.** Subcontractor payment certificates;
- **J.** Canceled checks (payroll and vendors);
- **K.** Job cost report;
- **L.** Job payroll ledger;
- **M.** General ledger, general journal, (if used) and all subsidiary ledgers and journals together with all supporting documentation pertinent to entries made in these ledgers and journals;
- **N.** Cash disbursements journal;
- **O.** Financial statements for all years reflecting operations on the Project;
- **P.** Income tax returns for all years reflecting operations on the Project;
- **Q.** Depreciation records on all equipment utilized whether the records are maintained by the Contractor, its accountant, or others;
- **R.** If a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all other source documents;
- **S.** All documents that reflect the Contractor's actual profit and overhead during the years the Project was being performed;
- **T.** All documents related to the preparation of the Contractor's Bid, including the final calculations on which the Bid was based, unless the documents are placed in escrow under provisions of the Instructions to Bidders;
- **U.** All documents that relate to the Claim together with all documents that support the amount of damages as to the Claim;
- **V.** Worksheets used to prepare the Claim establishing the cost components for items of the Claim including, but not limited to, labor, fringes, benefits and insurance, materials, equipment, Subcontractors, and all documents that establish the periods of time, individuals involved, the hours and rate of pay for the individuals; and
- **W.** All other documents required by CMHA to reasonably review the Claim.

11.11. False Certification of a Claim

11.11.1. If the Contractor falsely certifies all or any part of a Claim, the portion of the Claim falsely certified shall be denied, and may be sufficient cause for CMHA to exclude Contractor from future contracting opportunities as permitted by law.

11.11.2. The Contractor shall not knowingly present or cause to be presented to the Owner a false or fraudulent Claim.

- **A.** Knowingly shall have the same meaning as in the Federal False Claims Act.

11.11.3. If the Contractor knowingly presents or causes to be presented a false or fraudulent Claim, then the Contractor shall be liable to the Owner for the same civil penalty and damages as the United States Government would be entitled to recover and shall also indemnify and hold the Owner harmless from all costs and expenses, including Owner's attorneys' and consultants' fees and expenses incurred in investigating and defending against such Claim and in pursuing the collection of such penalty, damages and fees and expenses.

12. ARTICLE XII WARRANTY

12.1. Warranty of Title

12.1.1. The Contractor warrants good title to all materials, supplies, and equipment incorporated in the Work and agrees to deliver the premises together with all improvements thereon free from any claims, liens or charges, and agrees further that neither it nor any other person, firm or corporation shall have any right to a lien upon the premises or anything appurtenant thereto.

12.2. Warranty of Construction

12.2.1. In addition to any other warranties in this Contract, the Contractor warrants that work performed under this contract conforms to the Contract requirements and is free of any defect in equipment, material, or workmanship performed by the Contractor or any Subcontractor or supplier at any tier.

A. Work not conforming to those requirements, including Substitutions not properly approved and authorized, may be considered Defective Work.

B. If required by CMHA, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

12.2.2. The Contactor shall remedy, at the Contractor's expense, any Work that does not conform to the requirements of the Contract Documents, or any Defective Work.

A. In addition, the Contractor shall remedy, at the Contractor's expense, any damage to CMHA-owned or controlled real or personal property when the damage is the result of:

i. Any action or inaction by Contractor;

ii. The Contractor's failure to conform to Contract requirements; or

iii. Any defects of equipment, material, workmanship or design furnished by the Contractor.

12.2.3. The Contractor shall restore any work damaged in fulfilling the terms and conditions of Warranty of Construction.

A. The Contractor's Warranty with respect to work repaired or replaced shall be extended for a period of not less than one year, beyond the original Warranty period required under the Contract, of repair or replacement.

12.2.4. CMHA shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect or damage.

A. If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, CMHA shall have the right to replace, repair or otherwise remedy the failure, defect, or damage at the Contractor's expense.

12.2.5. With respect to all warranties, express or implied, from Subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:

A. Obtain all warranties that would be given in normal commercial practice;

B. Require all warranties to be executed in writing, for the benefit of CMHA; and

C. Enforce all warranties for the benefit of CMHA.

12.2.6. If the Contractor or a Subcontractor recommends a particular product, material, system, or item of equipment for incorporation into the Project and CMHA accepts that recommendation, the above Warranty shall include a warranty from the Contractor to CMHA that the recommended product, material, system, or item of equipment is fit and appropriate for the associated purpose.

12.3. Warranty Walk-through Contractor

12.3.1. At CMHA's request, Contractor shall perform a walkthrough of the property no earlier than three months prior to the expiration of any Warranty.

A. If Contractor is unavailable for the Warranty walk-thru, the Warranty shall be extended until the time Contractor is available.

13. ARTICLE XIII BONDS

13.1. Bid Bond/Guaranty

13.1.1. The Contractor shall provide to CMHA a Bid Guaranty in the form of either:

A. A Bond for 10% of the Bid; or

B. A certified check, cashier's check or letter of credit revocable only at the option of CMHA and shall be in the amount of 10% of the Bid.

13.1.2. The Bid Guaranty shall be conditioned to:

A. Provide that Contractor will, after award, enter into a contract with CMHA in accordance with the bid, plans, details, and specifications.

B. If the Bidder fails to enter into the Contract and CMHA awards Contract to next lowest bidder, the Bidder and the Surety on the Bidder's Bid are liable to CMHA for the lessor of either:

i. The difference between the Bidder's Bid amount and the bid amount of the next lowest bidder; or

ii. For a penal sum of the Bond in the amount of 10% of the Bidder's Bid.

C. If CMHA does not award the Contract to the next lowest bidder but resubmits the Project for bidding, the Bidder failing to enter into the Contract and the Surety on the Bidder's Bond are liable to CMHA for a penal sum on the Bond not to exceed 10% of the amount of the Bidder's Bid amount.

13.1.3. Where CMHA accepts a Bid but the Bidder fails or refuses to enter into a Contract in accordance with the Contract Documents included with the Bid, including the plans, details, and specifications, within ten (10) calendar days after Notice of Intent, the Bidder and Surety on any Bond are liable for the amount of the difference between the amount of the Bidder's Bid and the amount of the Bid from next lowest Bidder.

13.1.4. All Bid Guaranties shall be payable to CMHA, be for the benefit of CMHA and be deposited with CMHA.

13.2. Payment and Performance Bond

13.2.1. In addition to any other requirements in the Contract Documents, Contract Commencement does not occur until CMHA receives a Payment and Performance Bond.

13.2.2. Contractor shall, within ten (10) calendar days of CMHA's delivery of signed Contract to Contractor, unless otherwise specified by CMHA in writing, deliver to CMHA a payment and performance bond with a penal sum in the amount of 100% of the Contract Sum (which includes all acceptable alternates).

13.2.3. The Payment and Performance Bond shall contain the following a condition that indemnifies CMHA against all damages suffered by CMHA as a result of the failure of Contractor to perform the Work in accordance with the requirements of the Contract Documents, including, the plans, details, and specifications, and the Payment and Performance Bond shall state that Contractor shall pay all lawful claims of Subcontractors, material suppliers, and laborers for labor performed or material furnished in carrying forward, performing or completing the Contract.

13.2.4. All Bonds requirement by the Contract shall be obtained from companies holding certificates of authority as acceptable sureties and shall be listed on the U.S Treasury Circular 570 (T-List).

A. Each company shall be licensed to do business in Ohio and satisfactory to CMHA.

13.2.5. The Contractor shall submit with each executed Bond:

A. A certified copy of the authority to act (power of attorney) of the agent signing the Bond on behalf of the Surety, and

B. A current signed Certificate of Compliance issued by the Ohio Department of Insurance demonstrating that Surety is licensed to do business in Ohio.

13.2.6. If the Contract Sum increases at any time such that it exceeds the sum of the Bond, the Contractor shall cause the penal sum of the Bond to be increased such that the sum equals one-hundred percent of the increased Contract Sum.

13.2.7. Any time Contractor increases the sum of the Bond, the Contractor shall deliver to CMHA written consent of the affected Surety confirming the increased penal sum of the Bond.

A. CMHA's receipt of that written consent is a condition precedent to CMHA's obligation to pay the Contractor for any portion of the Work associated with the increase.

13.2.8. If notice of any change affecting the Contract is required by any Surety or by the provision of any Bond, the Contractor shall provide that notice.

14. ARTICLE XIV INSURANCE

14.1. Contractor's General Insurance Requirements

14.1.1. Throughout the performance of the Work or longer as may be described below, the Contractor and each Subcontractor shall obtain, pay for and keep in force, the minimum insurance coverage.

14.1.2. On a case-by-case basis, CMHA and Contractor may mutually agree to adjust the insurance requirements for any particular subcontractor.

14.1.3. All insurance shall be carried with companies which are financially responsible and admitted to do business in the State of Ohio.

A. If any such insurance is due to expire prior to Contract Completion, the Contractor (including Subcontractors, as applicable) shall not permit the coverage to lapse and shall furnish evidence of coverage to the Contracting Officer.

B. All certificates of insurance, as evidence of coverage, shall provide that no coverage may be canceled or non-renewed by the insurance company until at least thirty (30) calendar days prior written notice has been given to CMHA.

14.2. Minimum Coverage Requirements

14.2.1. Workers' Compensation:

A. In accordance with the State of Ohio Workers' Compensation laws

14.2.2. Commercial General Liability

A. With a combined single limit for bodily injury and property damage of not less than $1,000,000 per occurrence unless otherwise specified by CMHA in writing, to protect the Contractor and each subcontractor against claims for bodily injury or death and damage to the property of others.

B. This shall cover the use of all equipment, hoists, and vehicles on the site(s) not covered by Automobile Liability.

C. If the Contractor has a "claims made" policy, then the following additional requirements apply:

i. The policy must provide a "retroactive date" which must be on or before the execution date of the Contract; and

ii. The extended reporting period may not be less than five years following the completion date of the Contract.

14.2.3. Employers Liability Coverage

A. Unless otherwise specified by CMHA in writing**,** the Contractor shall maintain employer's liability coverage with:

i. An each accident limit of not less than $1,000,000;

ii. A disease each-employee limit of not less than $1,000,000; and

iii. A disease policy limit of not less than $1,000,000.

14.2.4. Automobile Liability

A. On owned and non -owned motor vehicles used on the site(s) or in connection therewith for a combined single limit for bodily injury and property damage of not less than $ 1,000,000 per occurrence.

14.2.5. Builder's Risk Insurance

A. Before commencing Work, the Contractor shall furnish CMHA with a certificate of insurance evidencing that **Builder's Risk** (fire and extended coverage) **Insurance** on all work in place and/or materials stored at the building site(s), including foundations and building equipment, is in force.

i. The Builder's Risk Insurance shall be for the benefit of the Contractor and CMHA as their interests may appear and each shall be named in the policy or policies as an insured.

ii. The Contractor if installing equipment supplied by CMHA shall carry insurance on such equipment from the time the Contractor takes possession thereof until the Contract work is accepted by CMHA.

iii. The Builder's Risk Insurance need not be carried on excavations, piers, footings, or foundations until such time as work on the superstructure is started.

iv. It need not be carried on landscape work.

v. Policies shall furnish coverage at all times for the full cash value of all completed construction, as well as materials in place and/or stored at the site(s), whether or not partial payment has been made by CMHA.

vi. The Contractor may terminate this insurance on buildings as of the date CMHA issues a Certificate of Contract Completion.

B. The amount of Builder's Risk coverage shall not be less than the total completed value of the Project, including the value of permanent fixtures and decorations, with a deductible of not more than $25,000 per occurrence.

i. Contractor shall be responsible for paying all deductibles for any and all claims made under the Builder's Risk policy; and,

ii. Any deductible over the amount specified in this provision shall be authorized in writing by CMHA.

C. Coverage shall include a provision to pay the reasonable extra costs of acceleration and expediting temporary and permanent repairs to, or permanent replacement of, damaged property.

i. This shall include overtime wages and the extra costs of "express" or other means of expedited transportation and/or delivery of supplies necessary to the repair of replacement.

D. Coverage shall include "soft costs endorsement" including, but not limited to, the reasonable extra costs of the A/E and reasonable Contractor extension or acceleration costs.

E. Coverage shall include material in transit or stored in off-site and identified for the Project.

F. Coverage shall waive all rights between CMHA, Contractor, and Subcontractors at any tier, for damages caused by fire or any other perils to the extent of actual recovery of any insurance proceeds under the policy.

G. Coverage shall include appropriate sub-limits for installation coverage.

H. Coverage shall include provisions for mechanical or electrical breakdown, or boiler system testing.

I. Coverage shall include temporary structures and scaffolding, along with collapse coverage.

J. Coverage shall be primary to all other applicable insurance.

K. The Builder's Risk policy shall specifically permit partial occupancy by CMHA prior to Contract Completion and coverage shall remain in effect until CMHA issues a Certificate of Contract Completion.

L. The Contractor's tools and equipment shall not be covered under the Builder's Risk policy.

i. It is the Contractor's sole responsibility to maintain insurance coverage for tools and equipment used on the Project, which shall be included in its Overhead (a component of Contractor's Fee) and not included as a separate item in Contractor's Schedule of Values.

M. If Contractor is involved solely in the installation of material and equipment and not in new building construction, the Contractor shall purchase and maintain a Builder's Risk, Builder's Risk-renovations, or installation floater insurance policy that complies with the requirements of Article XIV.

14.2.6. Umbrella/Excess Liability

A. The Contractor may employ an umbrella/excess liability policy to achieve the above required minimum coverage.

B. Unless otherwise specified by CMHA in writing, for Construction Contracts in excess $1,000,000, the Contractor shall maintain umbrella/excess liability coverage with a limit of not less than $2,000,000 (in addition to the above-required limits) if the Work (or Work to be performed by the Subcontractor) includes any of the following:

i. Brick/block masonry;

ii. Exterior caulking/sealant;

iii. Cast-in-place or precast concrete;

iv. Damp proofing/waterproofing;

v. Electrical;

vi. Elevator;

vii. Exterior glass and/or glazing;

viii. Exterior marble, granite, and/or other stonework;

ix. Miscellaneous metals;

x. Plaster/stucco;

xi. Plumbing;
xii. HVAC;
xiii. Roofing and/or sheet metal;
xiv. Scaffolding;
xv. Spray-on fireproofing;
xvi. Sprinkler and/or fire protection; or
xvii. Structural steel and/or metal deck.

C. Unless otherwise specified by CMHA in writing, the Contractor shall maintain umbrella/excess liability coverage with a limit of not less than $5,000,000 (in addition to the above-required limits) if the Work (or the Work to be performed by the Subcontractor) includes any of the following:
i. Caissons and/or piles;
ii. Major Demolition;
iii. Excavation and/or utility work;
iv. Sheeting, shoring, and/or underpinning;
v. Window washing equipment; or
vi. Wrecking.

14.2.7. Professional Liability – Contractor

A. Unless otherwise specified by CMHA in writing, the Contractor shall maintain professional liability insurance (including without limitation for sprinkler and/or fire protection and other design-build work included in the Work) without design-build exclusions with a limit not-less than $1,000,000 each claim and an annual-aggregate limit of not less than $2,000,000.

B. The professional liability policy shall have an effective date on or before the date that the Contractor first started to provide any Project-related services.

C. Upon submission of the associated certificate of insurance and at each policy renewal, the Contractor shall advise CMHA in writing of any actual or alleged claims that may erode the professional liability limits.

D. The Contractor shall maintain the professional liability insurance in effect for no less than 5 years after the earlier of the termination of the Contract or Substantial Completion of all Work.

14.2.8. Additional Property Insurance

A. For any demolition, blasting, excavating, tunneling, shoring, or similar operations, the Contractor shall provide and maintain Property Damage Liability insurance with a limit of liability equal to the limit as specified in the applicable provisions of ARTICLE XIV INSURANCE.

14.2.9. Equipment Coverage

A. CMHA will not insure or be liable for damage to any Contractor or Subcontractor owned, leased, rented, or borrowed tools, equipment, or vehicles.

B. The Contractor and Subcontractors are solely responsible for maintaining all insurance necessary to cover their tools, equipment, and vehicles.

14.3. Waivers of Subrogation

14.3.1. To the fullest extent permitted by applicable laws, the Contractor waives all rights against CMHA and its agents and employees for damages to the extent covered by any insurance, except rights to the proceeds of that insurance.

A. All policies shall accomplish the waiver of subrogation by endorsement or otherwise.

14.3.2. CMHA and Contractor waive all rights against each other for damages caused by fire or other perils to the extent actual recovery of any insurance proceeds under any property insurance or Builder's Risk insurance applicable to the Work.

15. ARTICLE XV INDEMNIFICATION

15.1. To the fullest extent permitted by Applicable Law, the Contractor shall indemnify, defend, and hold harmless the Indemnified Parties from and against all claims, costs, damages, losses, fines, penalties, and expenses (including but not limited to all fees and charges of attorneys and other professionals, and all court, arbitration, or other dispute-resolution costs) arising out of or in connection with the Project.

15.2. The Contractor's indemnification obligation under ARTICLE XV INDEMNIFICATION exists regardless of whether or not and the extent to which the claim, damage, loss, fine, penalty, or expense is caused by a party indemnified under ARTICLE XV INDEMNIFICATION.

15.2.1. Nothing in ARTICLE XV INDEMNIFICATION obligates the Contractor to indemnify any individual or entity from and against the consequences of that individual or entity's own negligence.

15.3. The Contractor's obligations under ARTICLE XV INDEMNIFICATION shall not extend to the liability of the A/E, A/E's consultants, agents, representatives, or employees for negligent preparation or approval of Drawings, Specifications, Change Orders, opinions, and other responsibilities of the A/E, except to the extent covered by the Contractor's insurance.

15.4. In claims against an Indemnified Party by any direct or indirect employee (or the survivor or personal representative of that employee) of the Contractor or a person or entity for whom the Contractor may be liable, the indemnification obligation under ARTICLE XV INDEMNIFICATION will not be limited by a limitation on the amount or type of damages, compensation, or benefits payable under workers' compensation acts, disability benefit acts, or other employee benefits acts.

15.5. The Contractor's indemnification obligation under ARTICLE XV INDEMNIFICATION will survive termination of the Contract and Date for Contract Completion.

15.6. CMHA may deduct from the Contract Sum any claims, losses, fines, penalties, and expenses for which the Contractor is liable under ARTICLE XV INDEMNIFICATION.

15.6.1. If those claims, damages, losses, fines, penalties and expenses exceed the unpaid balance of the Contract Sum, the Contractor shall immediately pay the difference to CMHA.

16. ARTICLE XVI DAMAGES

16.1. Liquidated Damages

16.1.1. If the Contractor fails reach Substantial Completion within the Contract Time for Substantial Completion, including any properly approved extension for the Contract Time for Substantial Completion, the Contractor shall pay to CMHA as Liquidated Damages, the sum of **$400.00** for each day of delay.

A. Liquidated Damages for the Date for Contract Completion and any Milestone Dates in the Contract, not including Substantial Completion, shall be assessed on in accordance

B. To the extent that the Contractor's delay or non-performance is excused under another clause in this Contract, Liquidated Damages shall not be due CMHA.

C. The Contractor remains liable for damages caused other than by delay.

16.1.2. If CMHA terminates the Contractor's right to proceed, the resulting damage will consist of Liquidated Damages incurred until the Date of Contract Completion, together with any increased costs incurred by CMHA in completing the Work.

16.1.3. If CMHA does not terminate the Contractor's right to proceed, the resulting damage will consist of Liquidated Damages incurred until the Date of Contract Completion.

16.1.4. If the Contractor fails to achieve a Milestone Date, excluding the Date for Substantial Completion, within the associated Contract Time, the Contractor shall (at CMHA's option) pay to or credit CMHA the Liquidated Damages per day sum determined according to the following schedule for each day that the Contractor fails to achieve a Milestone within the associated Contract Time.

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Contract Sum	Liquidated Damages per day
Less than $100,000	$200
From $100,000 to $500,000	$400
From $500,000.01 to $1,000,000	$500
From $1,000,000.01 to $3,000,000	$750
More than $3,000,000	$1,000

16.1.5. If the Contractor simultaneously fails to achieve two or more Milestones, including the Date for Substantial Completion, CMHA shall be entitled to recover the sum of the associated Liquidated Damages per day rates.

16.1.6. The Liquidated Damages described are only intended to compensate CMHA for the direct damages it incurs as a result of the Contractor's failure to achieve the Milestones, including the Date for Substantial Completion, within their associated Contract Times.

16.1.7. The Liquidated Damages described are not intended to compensate CMHA for any damages CMHA incurs on account of:

A. Any claims attributable to the Contractor that are brought by others including Separate Consultants and Separate Contractors; or

B. Any failure of the Contractor to timely, properly, and completely perform the Contract other than the failure to achieve the Milestones, including the Date for Substantial Completion, within their associated Contract Times.

16.1.8. The parties acknowledge that the above-listed Liquidated Damages per day sums are not penalties, and they each irrevocably waive the right (if any) to challenge the validity and enforceability of those Liquidated Damages per day sums.

A. Notwithstanding any other provision of the Contract Documents to the contrary, if a court determines that the Liquidated Damages per day sums or their application are void and unenforceable, CMHA shall be entitled to recover the actual damages that it incurs on account of the Contractor's failure to achieve the Date for Substantial Completion and/or one or more of the Milestones within the applicable Contract Times.

16.1.9. In addition to other rights that CMHA may have relative to the Liquidated Damages, CMHA may deduct the Liquidated Damages from the Contract Sum as the damages accrue.

A. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall immediately pay the amount of the insufficiency to CMHA. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, associated with the failure of the Contractor to timely and properly reimburse CMHA for any Liquidated Damages.

16.2. Mutual Waiver of Consequential Damages

16.2.1. Except as provided Liquidated Damages, CMHA and Contractor each waive against the other all Claims for consequential damages that may arise out of or relate to this Contract.

A. CMHA's waiver includes Claims for loss of use, income, profit, revenue, financing, cost of capital, business and reputation, management and employee productivity, and consequential damages arising from termination of the Contract or related to insolvency.

B. The Contractor's waiver includes:

i. Claims for unabsorbed home-office overhead;

ii. Any other form of overhead in excess of that specifically provided for;

iii. Delay damages except as otherwise specifically provided for;

iv. Increased cost of funds for the Project;

v. Lost opportunity to work on other projects;

vi. Losses of financing, business, and reputation;

vii. Loss of profit except anticipated profit, arising directly from properly performed Work;

viii. Loss of bonding capacity; and

ix. Consequential damages arising from termination of the Contract or related to insolvency.

16.2.2. Notwithstanding Section 16.2.1, this Section 16.2:

A. Does not apply to any damages that would be covered by insurance provided in connection with the Project if the Contract did not include Section 16.2.1 **;**

B. Does not apply to the Contractor's indemnity obligations for third-party claims against the Indemnified Parties even if those claims are for damages that Section 16.2.1 would otherwise preclude;

C. Does not preclude CMHA's recovery of Liquidated Damages; and

D. Does not apply to Claims for damages arising from CMHA's or the Contractor's gross negligence or willful misconduct.

16.3. This ARTICLE 16 shall survive termination of the Contract.

17. ARTICLE XVII EQUAL OPPORTUNITY

17.1. Prohibition Against Discrimination

17.1.1. During the performance of this Contract, the Contractor agrees as follows:

A. Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, or handicap.

B. The Contactor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, national origin, or handicap.

i. Such action shall include, but not be limited to:

(a) Employment;
(b) Upgrading;
(c) Demotion;
(d) Transfer
(e) Recruitment or recruitment advertising;
(f) Layoff or termination;
(g) Rates of pay or other forms of compensation; and
(h) Selection for training, including apprenticeship.

C. The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by CMHA that explain ARTICLE XVII EQUAL OPPORTUNITY.

D. The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor; state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, or handicap.

E. The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under ARTICLE XVII EQUAL OPPORTUNITY, and post copies of the notice in conspicuous places available to employees and applicants for employment.

F. The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

G. The Contractor shall furnish all information and reports required by Executive Order 11246, as amended, the Rehabilitation Act of 1973, as amended, and by rules, regulations, and orders of the Secretary of Labor, pursuant thereto.

i. The Contractor shall permit access to its books, records, and accounts by the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

H. In the event of a determination that the Contractor is not in compliance with ARTICLE XVII EQUAL OPPORTUNITY or any rule regulations, or order of the Secretary of Labor, this contract may be canceled, terminated or suspended in whole or in part, and the Contractor may be declared ineligible for further Government Contracts, or Federally assisted construction contracts under the procedures authorized, in Executive Order 11246, as amended.

i. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law, including the following as provided by ORC:

(a) In the event Contractor fails to comply with these nondiscrimination provisions, CMHA shall deduct from the amount payable to the Contractor a forfeiture of the statutory penalty pursuant to ORC for each person who is discriminated against or intimidated.

(b) The Contract may be terminated or suspended in whole or in part by CMHA and all money due hereunder may be forfeited in the event of a subsequent violation of the foregoing nondiscrimination provisions.

(c) The Contractor shall include the terms and conditions of ARTICLE XVII EQUAL OPPORTUNITY in every Subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each Subcontractor or vendor.

(d) The Contractor shall take such action with respect to any subcontract or purchase order as the Secretary of Housing and Urban Development or the Secretary of Labor may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into the litigations to protect the interests of the United States.

I. Compliance with the requirements of ARTICLE XVII EQUAL OPPORTUNITY shall be to the maximum extent consistent with, but not in derogation of compliance with the Indian Self-Determination and Education Assistance Act and the Indians Preference clause of this Contract.

J. The Contractor shall cooperate fully with the States Equal Opportunity Coordinator (EOC), with any other official or agency of the state of federal government that seeks to eliminate unlawful employment discrimination, and with all other state and federal efforts to assure equal employment practices under the Contract.

18. ARTICLE XVIII SECTION 3

18.1. In order to promote Employment, Job Training and Contracting Opportunities to low- and very low-income persons, the Contractor shall adhere to HUD's and CMHA's Section 3 Program requirements.

18.2. The Work to be performed under this Contract is subject to the provisions of Section 3 of the Housing and Urban Development Act of 1968, as amended.

18.2.1. The purpose of Section 3 is to ensure that employment and other economic opportunities generated by Federal financial assistance for housing and community development programs HUD assistance or HUD-assisted projects covered by Section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons particularly persons who are recipients of HUD assistance for housing.

18.3. The parties to this Contract agree to comply with HUD's regulations in 24 CFR § 75, which implement Section 3.

18.3.1. As evidence by the execution of the Contract, the parties to this Contract certify that they are under no contractual or other impediments that would prevent them from complying with the regulations.

18.4. The Contractor agrees to send to each labor organization or representative of workers with which the Contractor has a collective bargaining agreement or other understanding, if any, a narrative advising the labor organization or workers' representative of the Contractor's commitments, and will post copies of this notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice.

18.4.1. The notice shall describe the preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work will begin.

18.5. The Contractor agrees to include ARTICLE XVIII SECTION 3 in every subcontract subject to compliance with regulations in 24 CFR § 75, and agrees to take appropriate action, as provided in an applicable provision of the Subcontract or in ARTICLE XVIII SECTION 3, upon a finding that the Subcontractor is in violation of the regulations in 24 CFR § 75.

18.5.1. The Contractor will not Subcontract with any Subcontractor where the Contractor has notice or knowledge that the Subcontractor has been found in violation of the regulations in 24 CFR § 75.

18.6. The Contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the Contractor is selected but before the Contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR § 75 require employment opportunities to be directed, were not filled to circumvent the Contractor's obligations under 24 CFR § 75.

18.7. Noncompliance with HUD's regulations in 24 CFR § 75 may result in sanctions, termination of this Contract for default, and debarment or suspension from future HUD assisted contracts.

18.8. Section 3 Reporting Requirements

18.8.1. Monthly Section 3 Compliance Reports are required and are to be submitted to the Economic Inclusion Coordinator.

18.8.2. These reports should include a listing of the Contractor's current local workforce, any new hiring or subcontracting that has occurred, along with total labor hours and section 3 worker labor hours on all new hires and all subcontractors permanent employees working on the project.

18.9. The Contractor shall cooperate fully with requests for additional Section 3 information and documentation as needed by CMHA or the Contracting Authority.

19. ARTICLE XIX LABOR STANDARDS

19.1. Compliance with Davis Bacon and Related Acts requirements

19.1.1. All rulings and interpretations of the Davis Bacon and Related Acts contained in 29 CFR are herein incorporated by reference in this Contract.

19.2. Minimum Wages

19.2.1. All laborers and mechanics employed under this Contract in the development or construction of the project(s) involved will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act, the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

A. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the regular weekly period, are deemed to be constructively made or incurred during such weekly period.

B. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR.

C. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

D. The wage determination (including any additional classification and wage rates conformed under 29 CFR and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its Subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

19.2.2. Any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination.

A. HUD shall approve any additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

i. The work to be performed by the classification requested is not performed by a classification in the wage determination;

ii. The classification is utilized in the area by the construction industry; and

iii. The proposed wage rate, including bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

B. If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, Employee Standards Administration, U.S. Department of Labor, Washington, DC 20210.

i. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within thirty (30) calendar days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary.

C. In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator of the Wage and Hour Division for determination.

i. The Administrator or an authorized representative, should issue a determination within thirty (30) calendar days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time was necessary.

D. The wage rate (including fringe benefits where appropriate) shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in classification.

19.2.3. Whenever the minimum wage rate prescribed in the Contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

19.2.4. If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met.

A. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

19.3. Withholding of Funds

19.3.1. HUD or its designee shall, upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this Contract or any other Federal contract with the same prime Contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the Contract.

A. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working in the construction or development of the Project, all or part of the wages required by the contract, HUD or its designee may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

B. HUD or its designee may, after written notice to the Contractor or Subcontractor, issue payment to the respective employees to whom they are due.

19.4. Payrolls and Basic Records

19.4.1. Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working in the construction or development of the Project.

A. Such records shall contain:

i. The name, address, and social security number of each such worker;

ii. His or her correct classification

iii. Hourly rates of wages paid

(a) Including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in the Davis-Bacon Act;

iv. Daily and weekly number of hours worked;

v. Deductions made; and

vi. Actual wages paid.

B. Whenever the Secretary of Labor has found, under 29 CFR, that the wages of any laborer or mechanic include the amount of costs reasonably anticipated in providing benefits under a plan or program described in the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

i. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

19.4.2. The Contractor shall submit for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer for transmission to HUD or its designee.

A. The payrolls submitted shall set out accurately and completely all of the information required to be maintained.

B. This information may be submitted in any form desired.

i. Optional Form WH-347 is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

C. The Contractor is responsible for the submission of copies of payrolls by all Subcontractors (Approved by the Office of Management and Budget under OMB Control Number 1214-0149).

i. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or Subcontractor, or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(a) That the payroll for the payroll period contains the information required to be maintained and that such information is correct and complete;

(b) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or from the full wages earned, other than permissible deductions as set forth in 29 CFR; and

(c) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated in to the Contract.

ii. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirements for submission of the "Statement of Compliance".

iii. The falsification of any of the above certifications may subject the Contractor or Subcontractor to civil or criminal prosecution under Title 18 and Title 31 of the United States Code.

19.4.3. Records

A. The Contractor or Subcontractor shall make the records available for inspection, copying, or transcription by authorized representatives of HUD or its designee, the Contracting Officer, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job.

B. If the Contractor or Subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds.

C. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR.

19.5. Apprentices & Trainees

19.5.1. Apprentices will be permitted to work at less than predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship and Training, Employer and labor Services (OATELS), or with a State Apprenticeship Agency recognized by OATELS, or if a person is employed in his or her first ninety (90) calendar days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by OATELS or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

A. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program.

i. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed , shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed.

ii. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

B. Where a Contractor is performing construction on a project in a locality other than that in which registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed.

C. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination.

i. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program.

ii. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification.

iii. If the Administrator of the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

D. In the event OATELS, or a State Apprenticeship Agency recognized by OATELS, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

19.5.2. Trainees

A. Except as provided for in 29 CFR, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

B. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

C. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination.

i. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program.

ii. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices.

iii. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed.

iv. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed.

D. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work until an acceptable program is approved.

19.5.3. Equal Employment Opportunity

A. The utilization of apprentices, trainees, and journeymen shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended and 29 CFR.

19.6. Compliance with Copeland Act requirements

19.6.1. The requirements of 29 CFR, which are hereby incorporated by reference in this Contract

19.7. Contract Termination; Debarment

19.7.1. A breach of ARTICLE XIX LABOR STANDARDS may be grounds for termination of the Contract and for debarment as a Contractor and a subcontractor.

19.8. Disputes Concerning Labor Standards

19.8.1. Disputes arising out of the labor standards provisions of Disputes Concerning Labor Standards shall not be subject to ARTICLE XI DISPUTE RESOLUTION/CLAIM PROCEDURE of this contract.

A. Such disputes shall be resolved in accordance with the procedures of the Department of Labor.

19.8.2. Disputes within the meaning of Disputes Concerning Labor Standards include disputes between the Contractor (or any of its Subcontractors) and CMHA, HUD, the U.S. Department of Labor, or the employees or their representatives.

19.9. Certification of Eligibility

19.9.1. By entering into this Contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded contracts by virtue of the Davis-Bacon Act or 29 CFR.

19.9.2. No part of this Contract shall be subcontracted to any person or firm ineligible for award of a United States Government contract by virtue of the Davis-Bacon Act or 29 CFR.

19.9.3. The penalty for making false statements is prescribed in the U. S. Criminal Code 18 U.S.C.

19.10. Contract Work Hours and Safety Standards Act

19.10.1. As used in 19.10 - Contract Work Hours and Safety Standards Act, the terms "laborers" and "mechanics" include watchmen and guards.

19.10.2. Overtime Requirements

A. No Contractor or Subcontractor contracting for any part of the Contract Work which may require or involve the employment of laborers or mechanics, including watchmen and guards, shall require or permit any such laborer or mechanic in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one half pay for all hours worked in excess of 40 hours in such workweek.

19.10.3. Violation; liability for unpaid wages; Liquidated Damages

A. In the event of any violation, the Contractor and any Subcontractor responsible therefor shall be liable for the unpaid wages.

B. In addition, such Contractor and Subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages.

C. Such liquidated damages shall be computed with respect to each individual laborer or mechanic (including watchmen and guards) employed in violation, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages.

19.10.4. Withholding for unpaid wages and liquidated damages

A. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of Work performed by the Contractor or Subcontractor under any such Contract or any Federal contract with the same prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or Subcontractor for unpaid wages and liquidated damages.

19.11. Subcontracts

19.11.1. The Contractor or Subcontractor shall insert in any Subcontracts all the provisions contained in Subcontracts, and such other clauses as HUD or its designee may by appropriate instructions require, and also a clause requiring the Subcontractors to include these provisions in any lower tier Subcontracts.

19.11.2. The prime Contractor shall be responsible for the compliance by any Subcontractor or lower tier Subcontractor with all these provisions.

19.12. Non-Federal Prevailing Wage Rates

19.12.1. Any prevailing wage rate (including basic hourly rate and any fringe benefits), determined under State or tribal law to be prevailing, with respect to any employee in any trade or position employed under the Contract, is inapplicable to the Contract and shall not be enforced against the Contractor or any Subcontractor, with respect to employees engaged under the contract whenever such non-Federal prevailing wage rate exceeds:

A. The applicable wage rate determined by the Secretary of Labor pursuant to the Davis-Bacon Act (40 U.S.C.) to be prevailing in the locality with respect to such trade;

B. An applicable apprentice wage rate based thereon specified in an apprenticeship program registered with the U.S. Department of Labor (DOL) or a DOL- recognized State Apprenticeship Agency; or

C. An applicable trainee wage rate based thereon specified in a DOL-certified trainee program.

20. ARTICLE XX HEALTH, SAFETY AND ACCIDENT PREVENTION

20.1. General Contractor Requirements

20.1.1. In performing this Contract, the Contractor shall:

A. Take reasonable precautions to ensure safety of individuals on the Project;

B. Ensure that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his/her health and/or safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation;

C. Protect the lives, health, and safety of other persons;

D. Prevent damage to property, materials, supplies, and equipment; and

E. Avoid work interruptions.

20.1.2. For these purposes, the Contractor shall:

A. Comply with regulations and standards issued by the Secretary of Labor .

i. Failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act; and

B. Include the terms of ARTICLE XX HEALTH, SAFETY AND ACCIDENT PREVENTION in every Subcontract that such terms will be binding on each Subcontractor.

C. The Contractor shall be responsible for its Subcontractors' compliance with the provisions of ARTICLE XX HEALTH, SAFETY AND ACCIDENT PREVENTION.

i. The Contractor shall take such action with respect to any Subcontract as CMHA, the Secretary of Housing or Secretary of Labor shall direct as a means of enforcing such provisions.

D. The Contractor shall maintain an accurate record of exposure data on all accidents incident to work performed under this Contract resulting in death, traumatic injury, occupational diseases or damages to property, materials, supplies, or equipment, and shall report this data in the manner prescribed by 29 CFR;

E. The Contractor shall pay any fine or cost incurred because of Contractor's violation, or alleged violation, of any Applicable Law.

20.2. Notification of Non-Compliance Procedure

20.2.1. To the extent CMHA is aware of Contractor's noncompliance with the safety requirements in the Contract, CMHA shall notify the Contractor of any noncompliance with these requirements and of the corrective action required. However, CMHA's failure to notify Contractor of noncompliance with any applicable safety requirements, does not relieve Contractor of any obligation to comply with safety requirements for the Project.

A. This notice, when delivered to the Contractor or the Contractor's representative at the site of the work, shall be deemed sufficient notice of the noncompliance and corrective action required.

20.2.2. After receiving the notice, the Contractor shall immediately take corrective action.

20.2.3. If the Contractor fails or refuses to take corrective action promptly, CMHA may issue an order stopping all or part of the work until satisfactory corrective action has been taken.

20.2.4. The Contractor shall not base any claim or request for equitable adjustment for additional time or money on any stop order issued under Section 20.2.

20.3. Safety Plan

20.3.1. The Contractor is responsible for designing and implementing its own site-specific safety plan, including compliance with OSHA regulations and such plan shall meet or exceed CMHA's site-specific safety plan (if any).

20.3.2. Before starting any Work, the Contractor shall submit to CMHA a copy of the Contractor's site-specific safety plan and safety manuals.

20.4. Safety Data Sheets

20.4.1. The Contractor shall identify any material it uses at the Site with a Safety Data Sheet ("SDS") meeting the requirements of OSHA's Hazardous Communication Standard.

20.4.2. The Contractor shall maintain a notebook containing all of its applicable SDSs.

A. This notebook shall be kept at the Site for the duration of the Project.

20.5. Hazardous Materials

20.5.1. Prohibition Against Hazardous Materials

A. The Contractor shall not introduce Hazardous Materials to the Project

20.5.2. Work Stoppage Due to Hazardous Materials

A. If the Contractor encounters material the Contractor reasonably believes to be, or contain, a Hazardous Material that has not been rendered harmless, the Contractor shall immediately stop Work in the affected area and verbally report the condition to CMHA, and within one (1) business day deliver written notice of the condition to CMHA.

B. CMHA will promptly determine the necessity of CMHA retaining a qualified environmental consultant to evaluate the suspected Hazardous Material and to issue a related written report.

i. Where appropriate, CMHA will engage a licensed abatement contractor to remove the material or render it harmless as directed.

C. The Contractor shall resume Work in the affected area upon written notice from CMHA that:

i. The suspect material was evaluated and found not to be or contain a Hazardous Material; or

ii. The suspect material has been removed or rendered harmless.

D. If the Contractor knowingly or negligently proceeds with the Work in an area where a Hazardous Material exists and has not been rendered harmless, the Contractor shall be solely responsible for all related claims, damages, losses, and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from performing the Work in the affected area. Further, to the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, associated with Contractor knowingly or negligently proceeds with the Work in an area where a Hazardous Material exists and has not been rendered harmless.

E. The term "rendered harmless" means that the level of exposure is less than any applicable exposure standards set forth in Applicable Law.

20.6. Fires or Hot-Work

20.6.1. Contractor shall not burn any fires on the Site(s).

A. The Contractor shall notify the Project Manager twenty-four (24) hours before the start of non-routine or non-recurring hot-work.

i. Use of sources of fire, flame or sparks and flammable materials shall be kept to an absolute minimum.

ii. At the beginning of the Project, the Contractor shall inform the Project Manager of its intent to use blowtorches, welding apparatus or similar exposed flame and sparking devices.

iii. Similar notice shall be given in regard to the use of flammable liquids, adhesives, and cleaners.

B. The Contractor shall furnish an appropriate number of fire extinguishers (minimum of 1), which shall be within the immediate areas where work is being done at all times.

i. The extinguisher shall be adequate and suitable for the class of fire likely to be caused by the Contractor's operations.

20.7. Explosives and Blasting

20.7.1. The Contractor shall not conduct blasting on, or bring explosives to the Work Site without written approval of CMHA and other authorities with jurisdiction.

20.7.2. The Contractor shall perform all blasting, storing, and handling of explosives as required under Applicable Law.

20.7.3. The Contractor shall carry appropriate liability insurance coverage, as required by the Contract Documents, for its blasting and explosives storage and handling operations.

A. Immediately upon request, the Contractor shall deliver evidence of that insurance to CMHA.

21. ARTICLE XXI CONTRACT DOCUMENTS AND CONTRACT RECORDS

21.1. Examination and Retention of Contractor's Records

21.1.1. CMHA, HUD, or the Comptroller of the United States, or any of their duly authorized representatives shall, until three (3) years after final payment under this Contract, have access to and the right to examine any of the Contractor's directly pertinent books, documents, papers, or other records involving transactions related to this Contract for the purpose of making audit, examination, excerpts, and transcriptions.

21.1.2. The Contractor agrees to include in first-tier Subcontracts under this Contract a clause substantially the same as 21.1.1.

A. "Subcontract," as used in Examination and Retention of Contractor's Records, excludes purchase orders not exceeding $10,000.

21.1.3. The periods of access and examination for records relating to (1) appeals under ARTICLE XI DISPUTE RESOLUTION/CLAIM PROCEDURE of this contract, (2) litigation or settlement of claims arising from the performance of this Contract, or (3) costs and expenses of this Contract to which CMHA, HUD, or Comptroller General or any of their duly authorized representatives has taken exception shall continue until disposition of such appeals, litigation, claims, or exceptions.

21.1.4. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, arising out of or related to any dispute regarding what Person or Persons should be given access to the documents under Section 21.1.

21.1.5. The right of inspection, audit, and reproduction extends to all documents necessary to permit CMHA, or its agents, to perform a complete evaluation of all of the Contractor's costs related to the Project, including, but not limited to, the cost of pricing data submitted along with the computations and projections used therein.

21.1.6. If the Contract has been terminated, in whole or in part, the records relating to the Work terminated shall be made available to CMHA for a period of six (6) years from the date of termination.

21.2. Examination and Audit of Contractor's Records

21.2.1. CMHA may examine all books, records, documents and other data of the Contractor and its Subcontractors related to the bidding, pricing, or performance of the Work for any purpose, including, but not limited to, evaluating any Contractor Payment Request, Proposal, Modification, or Claim.

21.2.2. The above referenced materials shall be made available at the office of the Contractor or Subcontractor, as applicable, at all reasonable times for inspection, audit, and reproduction until the expiration of six (6) years after the date of Substantial Completion of all Work.

A. The Contractor shall maintain, and require its Subcontractors to maintain, complete and accurate business records at its principal place of business.

i. If the principal place of business is greater than 50 miles from the Site, the Contractor shall timely make records available, and shall require its Subcontractors to timely make records available, at the office of CMHA upon request for the records.

B. To the extent that the Contractor or Subcontractor, as applicable, informs CMHA in writing that any documents provided to CMHA are trade secrets, CMHA shall treat these documents, to the extent permitted by law, as trade secrets of the Contractor or Subcontractor, as applicable.

i. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify, defend and hold harmless CMHA, from and against all claims, costs, losses, and damages, including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs, arising out of or related to any dispute regarding what Person or Persons should be given access to the documents under Section 21.2.

21.2.3. The right of inspection, audit, and reproduction extends to all documents necessary to permit adequate evaluation of the cost of pricing data submitted along with the computations and projections used therein.

21.2.4. If the Contract has been terminated, in whole or in part, the records relating to the Work terminated shall be made available to CMHA for a period of six (6) years from the date of termination.

21.2.5. Records that relate to disputes, litigation, or settlement of Claims arising out of the performance of the Work shall be made available until the dispute, litigation or Claims have been finally decided or settled.

21.3. Ownership of Contract Documents

21.3.1. CMHA shall have exclusive ownership of, all proprietary interest in, and the right to full and exclusive possession of all information, materials and documents discovered or produced by Contractor pursuant to the terms of this Contract, including but not limited to reports, memoranda, drawings or letters concerning the research and reporting tasks of this Contract.

21.3.2. For data other than computer software, the Contractor grants to CMHA and others acting on its behalf, a paid-up, nonexclusive, irrevocable, world-wide license in such copyrighted data to reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly by or on behalf of CMHA.

21.3.3. CMHA alone owns the Contractor's Documents and the Contract Documents and every right, title, and interest therein.

21.3.4. The Contractor must execute and deliver and cause its agents and subcontractors to execute and deliver, to CMHA any transfers, assignments, documents or other instruments necessary to vest in CMHA the complete right, title, interest in and ownership of the Contractor's Documents.

21.3.5. The Contractor may retain copies of the Contractor's Documents and the Contract Documents for information, reference, and performance of the Work.

21.3.6. The submission or distribution of the Contractor's Documents or the Contract Documents to meet official regulatory requirements or for similar purposes in connection with the Project is not a waiver of CMHA's reserved rights in the Contractor's Documents.

A. Any unauthorized use of the Contractor's Documents or the Contract Documents shall be at the sole risk of the entity making the unauthorized use.

21.4. Intent of Contract Documents

21.4.1. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of Work by the Contractor.

21.4.2. The Contract Documents are complementary, and what is required by one is binding as if required by all.

21.4.3. The Contractor shall provide all labor materials necessary for the entire completion of the Work described in the Contract Documents and reasonably inferable to produce the intended results.

21.4.4. The Drawings govern dimensions, details, and location of the Work.

A. The Specifications govern the quality of materials and workmanship.

21.4.5. The organization of the Specifications in divisions, sections, and articles, and the arrangement of Drawings shall not restrict the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

21.4.6. Unless otherwise defined in the Contract Documents, words that have well known technical or construction industry meanings are used within those recognized meanings.

21.5. Use of Electronic Files

21.5.1. CMHA and Contractor reasonably expect that they will provide Electronic Files to each other to facilitate the design and construction of the Project consistent with current practices and customs in the construction industry.

21.5.2. CMHA and Contractor acknowledge that the use of Electronic Files involves risks not generally associated with the use of paper documents.

A. Those risks may include, but not be limited to, alteration (inadvertent or intentional) and deterioration, both of which may not be apparent through casual observation.

21.5.3. In the event of a discrepancy between information contained in a paper version of a document and the Electronic File of that document, the paper will govern.

21.5.4. Use of Electronic Files does not relieve the Contractor of its responsibility for the preparation, completeness, or accuracy of the Contractor's Documents.

21.6. Order of Precedence

21.6.1. In the event of any inconsistency or conflict within any of the Contract Documents, the Contractor shall provide the better quality of Work and comply with the stricter requirement.

21.6.2. In the event of a conflict between the contract and any applicable state or local law or regulation, the state or local law or regulation shall prevail; provided that such state or local law or regulation does not conflict with, or is less restrictive than applicable federal law, regulation, or Executive Order.

A. In the event of such a conflict, applicable federal law, regulation, and Executive Order shall prevail.

22. ARTICLE XXII MISCELLANEOUS

22.1. Assignment

22.1.1. The Contractor shall not assign or transfer any interest in this Contract; except that Claims for monies due or to become due from CMHA under the Contract may be assigned to a bank, trust company, or other financial institution.

A. Such assignments of claims shall only be made with the written concurrence of CMHA.

B. If the Contractor is a partnership, this contract shall inure to the benefit of the surviving or remaining member(s) of such partnership as approved by CMHA.

22.1.2. Assignment of Antitrust Claims:

A. By signing the Agreement, the Contractor assigns, conveys and transfers to CMHA any right, title, and interest to any claims or causes of action it may have or acquire under state or federal antitrust laws relating to any goods, products, or services purchased, procured, or rendered to CMHA pursuant to the Contract.

22.1.3. CMHA and Contractor each bind themselves, their successors, assigns and legal representatives, to the other party to this Contract and to the successors, assigns, and legal representatives of the other party with respect to the Contract.

22.2. Contractor Performance Evaluation

22.2.1. CMHA may evaluate the Contractor's Performance at any time including without limitation during the progress of the Work, at the completion of a phase of the Project, and/or completion of the Project.

22.2.2. CMHA shall retain the evaluation.

A. The Contractor may request a copy of the completed evaluation(s).

i. If the Contractor wishes to comment or take exception to any rating or remark, the Contractor must send a response in writing to CMHA within thirty (30) calendar days of Contract Completion and/or Termination.

B. CMHA may use the evaluation(s) in determining the responsibility of the Contractor for award of future contracts.

C. Poor evaluations may lead to a determination that Contractor is not responsible and therefore ineligible for award of future contracts for a period of not less than one year.

D. CMHA may request information from the Contractor for use in evaluating the A/E's performance.

i. If information is requested, the Contractor shall comply in a timely and responsive manner.

E. If a breach of the Contract is committed by the Contractor or is attributable to a Subcontractor, that breach will be used in the responsibility analysis of the Contractor and Subcontractor (where applicable) for future contracts or subcontracts for a period of five (5) years after the date of the breach unless said breach results in Contractor being placed on debarment list, then for the period provided therein.

22.3. Prohibition Against Liens

22.3.1. The Contractor is prohibited from placing a lien on CMHA's property.

A. This prohibition shall apply to all Subcontractors at any tier and all materials suppliers.

22.4. Conflict of Interest

22.4.1. Interest of Members of Congress

A. No member of or delegate to the Congress of the United States of America shall be admitted to any share or part of this contract or to any benefit that may arise therefrom.

22.4.2. Interest of Members, Officers, or Employees and Former Members, Officers, or Employees

A. No member, officer, or employee of CMHA, no member of the governing body of the locality in which the Project is situated, no member of the governing body of the locality in which CMHA was activated, and no other public official of such locality or localities who exercises any functions or responsibilities with respect to the Project, shall, during his or her tenure, or for one year thereafter, have any interest, direct or indirect, in this Contract or the proceeds thereof.

22.5. Limitation on Payments Made to Influence Certain Federal Financial Transactions

22.5.1. The Contractor agrees to comply with Title 31, United States Code which prohibits the use of Federal appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions:

- **A.** The awarding of any Federal contract;
- **B.** The making of any Federal grant;
- **C.** The making of any Federal loan;
- **D.** The entering into of any cooperative agreement; or
- **E.** The modification of any Federal Contract, grant, loan, or cooperative agreement.

22.5.2. The Contractor further agrees to comply with the requirement of the Act to furnish a disclosure (OMB Standard Form LLL, Disclosure of Lobbying Activities) if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

22.6. Procurement of Recovered Materials

22.6.1. In accordance with the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, the Contractor shall procure items designated in guidelines of the Environmental Protection Agency (EPA) 40 CFR that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition.

- **A.** The Contractor shall procure items designated in the EPA guidelines that contain the highest percentage of recovered materials practicable unless the Contractor determines that such items:
  - **i.** Are not reasonably available in a reasonable period of time;
  - **ii.** Fail to meet reasonable performance standards, which shall be determined on the basis of the guidelines of the National Institute of Standards and Technology, if applicable to the item; or
  - **iii.** Are only available at an unreasonable price.

22.6.2. 22.6.1 shall apply to items purchased under this contract where:

- **A.** The Contractor purchases in excess of $10,000 of the item under this contract; or
- **B.** During the preceding:
  - **i.** Purchased any amount of the items for use under a contract that was funded with Federal appropriations and was with a Federal agency or a State agency or agency of a political subdivision of a State; and
  - **ii.** Purchased a total of in excess of $10,000 of the item both under and outside that contract.

22.7. Royalties and Patents

22.7.1. The Contractor shall pay all royalties and license fees and assume all costs incident to the use, in the performance of the Work or the incorporation in the Work, of any design, inventions, process, product, or devise that is the subject of patent rights or copyrights held by others.

- **A.** Contractor shall defined all suits or claims for infringement of any patent rights or copyrights and shall save CMHA harmless from loss on account thereof; except that CMHA shall be responsible for all such loss when a particular design, process, or the product of a particular manufacturer or manufacturers is specified and the Contractor has no reason to believe that the specified design, process, or product is an infringements.
- **B.** If, however, the Contractor has reason to believe that any design, process or product specified is an infringement of a patent or copyright, the Contractor shall promptly notify the Contracting Officer.
  - **i.** Failure to give such notice shall make the Contractor responsible for resultant loss.

22.8. Contract Time for Substantial Completion

22.8.1. The Contractor shall have the Work Substantially Complete as established in the Notice to Proceed issued by CMHA. If a Notice to Proceed is not issued, the date for commencement of the Work shall be the effective date of the Contract.

22.9. Other Contracts

22.9.1. CMHA may undertake or award other contracts for additional work at or near the site of the Work under this contract.

22.9.2. The Contractor shall fully cooperate with the other contractors and with CMHA employees and shall carefully adapt scheduling and performing the work under this Contract to accommodate the additional work, heeding any direction that may be provided by CMHA.

22.9.3. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by CMHA employees.

22.10. Drug-Free Workplace

22.10.1. Each contractor shall be enrolled in and in good standing and shall require all subcontractors with whom the Contractor is in contract for the public improvement to be enrolled in and be in good standing in the Bureau of Workers' Compensation's Drug-Free Workplace Program or a comparable program approved by the Bureau that meets the requirements specified in the Revised Code prior to a subcontractor providing labor at the Project site of the public improvement.

22.11. Energy Efficiency and Sustainability Requirements

22.11.1. The Contractor shall comply with mandatory standards and policies relating to energy efficiency which are contained in the energy conservation plan issued in compliance with the Energy Policy and Conservation Act for the State in which the work under the contract is performed.

22.11.2. If the Project is designed and constructed under the Leadership in Energy and Environmental Design ("LEED") Rating System developed by the U.S. Green Building Council or another rigorous rating system used to facilitate achievement of sustainability goals for the Project, the Contractor shall provide submittals certifying achievement of sustainable designed rating system criteria for verification by the Green Building Certification Institute or other third party in accordance with the Contract Documents.

22.12. Clean Air and Water

22.12.1. The Contactor shall comply with the Clean Air Act, as amended 42 USC, the Federal Water Pollution Control Water Act, as amended 33 U.S.C., and standards issued pursuant thereto in the facilities in which this Contract is to be performed.

22.13. Public Relations

22.13.1. Public relations or publicity about the Project shall be solely within the control of and consent of CMHA.

22.13.2. Contractor shall submit to CMHA all advertising and publicity related matter relating to this Contract, including without limitation, information provided in social media, wherein CMHA's name is mentioned or language used from which the connection of CMHA's name may, in CMHA's judgment, be inferred or implied.

A. Contractor shall not publish or use such advertising and publicity matters without prior express written consent of CMHA.

22.14. Governing Law

22.14.1. This Contract shall be governed and construed exclusively by its terms and by the laws of the State of Ohio and any suit filed to enforce any term of this Contract shall be filed only in a court of competent jurisdiction in Hamilton County, Ohio.

22.14.2. The parties to this Contract shall comply with applicable law.

22.15. Written Notice

22.15.1. Notice under the Contract Documents shall be validly given if:

A. Delivered personally to a member of the organization for whom the notice is intended.

22.16. Taxes

22.16.1. Parties acknowledge that CMHA is a tax exempt entity and Contractor must use tax exemption status for all purchases made for the Project in which tax emption is permitted under law.

22.17. Computing Time

22.17.1. When the Contract Documents refer to a period of time by a number of days, the period shall be computed to exclude the first and include the last day of the period.

A. If the last day of the period falls on a Saturday or Sunday, or a legal holiday, that say shall be omitted from the computation and the period shall end on the next business day.

22.17.2. Except as excluded, the Contract Times and all other periods referred to in the Contract Documents includes Saturdays, Sundays, and all days defined as legal holidays below.

22.17.3. The standard workdays for the Work are Monday through Friday, excluding legal holidays.

22.17.4. The Legal Holidays are as follows:

- **A.** New Year's Day
- **B.** Martin Luther King Jr. Day
- **C.** President's Day
- **D.** Memorial Day
- **E.** Independence Day
- **F.** Labor Day
- **G.** Columbus Day
- **H.** Veterans Day
- **I.** Thanksgiving Day
- **J.** Christmas Day

22.18. Time is of the Essence

22.18.1. All time limits set forth in the Contract Documents are of the essence.

- **A.** By signing this Contract, Contractor acknowledges that the Contract Times are reasonable, taking into consideration the usual weather and other conditions prevailing in the locality of the Project.
- **B.** By signing the Construction Progress Schedule, the Contractor acknowledges that the specified Milestone dates and the Date for Substantial Completion are reasonable, taking into consideration the usual weather and other conditions prevailing in the locality of the Project.

22.18.2. The Notice to Proceed establishes the date for commencement of the Work.

22.18.3. The Contractor acknowledges that it may be subject to interference, disruption, hindrance, or delay in the progress of the Work from any cause.

- **A.** The sole remedy for such interference, disruption, hindrance, or delay shall be an extension of the Contract TimeMODIFICATIONS, unless otherwise required by law.

22.19. Extent of Contract

22.19.1. The Contract Documents represent the entire and integrated agreement between CMHA and the Contractor and supersede all prior negotiations, representations, or agreement, either written or oral.

22.19.2. This Contract may be executed in any number of counterparts, each of which shall be regarded as original and all of which constitute but one and the same instrument.

22.19.3. The captions and headings in this Contract are for convenience only and in no way define, limit, or describe the scope or intent of any of the provisions or sections hereof.

22.20. Severability

22.20.1. If any provision of this Contract is determined by a court having jurisdiction to be unenforceable to any extent, the rest of the provisions of this Contract will remain enforceable to the fullest extent permitted by law.

22.21. Facsimile/Electronic Mail Signature

22.21.1. Any party hereto may deliver a copy of its counterpart signature page of any Contract Documents via email, fax, or web-based project management software.

22.21.2. Each party shall be entitled to rely upon a scanned or facsimile signature of the other party in such a manner as if such a signature were an original.

22.22. No Third Party Interest

22.22.1. Except as expressly provided herein, no person or entity, other than CMHA and Contractor, will have any right or interest under the Contract, and the Contract does not create a contractual relationship of any kind between any persons or entities other than CMHA and the Contractor.

22.23. No Waiver

22.23.1. The failure of CMHA or Contractor to insist on anyone or more instances upon strict performance of any one or more of the provisions of the Contract or to exercise any rights under the Contract or provided by law will not be construed as a waiver or relinquishment of that provision or of the right to subsequently demand strict performance or exercise the right and the rights will continue unchanged and remain in full force and effect.

22.24. Assignment of Antitrust Claims

22.24.1. By signing this Contract, the Contractor conveys, assigns and transfers to CMHA any right, title, and interest in any claims or causes of action it may have or acquire under state or federal antitrust laws relating to any goods, products, or services purchased, procured, or rendered to CMHA pursuant to this Contract.

22.25. Survival of Obligations

22.25.1. All representations, indemnity obligations, warranties, guarantees, and other expressed continuing obligations under the Contract, will survive final payment, completion and acceptance of the Work, and termination or completion of the Contract.

22.26. Force Majeure

22.26.1. Neither party shall be liable for failure to perform if such failure is caused by conditions beyond its control including, but not limited to, Acts of God, Government restrictions (including the denial or cancellation of any export or other necessary license), wars, and/or insurrections.

22.27. Privacy

22.27.1. The Contractor agrees to Comply with the Privacy Act of 1974 (the Act) and the agency rules and regulations issued under the Act and any Personal information collected, used, or acquired in connection with this Contract shall be protected against unauthorized use, disclosure, modification or loss.

22.27.2. Contractor shall ensure that its directors, officers, employees, subcontractors or agents use personal information solely for the purposes of accomplishing the services set forth herein.

22.27.3. Contractor agrees not to release, divulge, publish, transfer, sell or otherwise make known to unauthorized persons personal information without express written consent of CMHA or otherwise required by law.

22.27.4. Contractor agrees to indemnify and hold harmless CMHA for any damages related to Contractor's unauthorized use of personal information.

22.28. Contractor Status

22.28.1. It is understood that the Contractor is an independent contractor and is not to be considered an employee of CMHA, or assume any right, privilege or duties of an employee.

23. ARTICLE XXIII DEFINITIONS AND TERMINOLOGY

23.1. Whenever used in the Contract Documents, the terms listed below will have the meanings meaning ascribed which are applicable to both the singular and the plural and the male and female gender thereof:

23.1.1. Abandonment

A. A willful decision by the Contractor suspending the progress of the work for an uninterrupted period of three (3) or more consecutive days (excluding weekends and holidays) and such suspension was not requested by CMHA and not caused by natural occurrences or acts of God.

23.1.2. Acceptable Component

A. A component listed in the Specifications after the Basis of Design Component.

23.1.3. Addenda

A. Written or graphic instruments issued prior to the opening of Bids that clarify, correct, or change the Bidding requirements or the Contract Documents.

23.1.4. Agreement

A. The form provided by CMHA, including all of its exhibits, that, when completed and signed by the Contractor and CMHA is evidence of the execution of the Contract.

23.1.5. Allowance

A. An amount budgeted for during the Bidding process for an item that has yet to be specified or defined and for which no exact dollar amount is available.

23.1.6. Alternate

A. A change in the proposed Project scope, which may include alternate materials or methods of construction and an amount stated on the Bid form to be added or deducted from the Base-Bid if the corresponding Alternate is incorporated into the Contract.

23.1.7. Applicable Law

A. All federal, state, and local codes, statutes, ordinances, and regulations that apply to the performance of the Work.

23.1.8. Architect/Engineer (A/E)

A. The person or other entity engaged by the CMHA to perform architectural, engineering, design, and other services related to the work as provided for in the Contract.

B. When CMHA uses an engineer to act in this capacity, the terms “architect” and “engineer” shall be synonymous.

23.1.9. Asbestos

A. Any material that contains more than one percent (1%) asbestos fiber and is friable or is releasing asbestos fibers into the air above current action levels established by OSHA

23.1.10. As-Built Documents

A. Drawings, addenda, Specifications, executed Change Orders and other elements of the Contract Documents which the Contractor annotates and otherwise modified to indicate changes made during the construction process, the location of concealed and buried items, and other information useful to CMHA throughout the life of the completed Project.

23.1.11. Base-Bid

A. The amount stated in a Bid as the sum for which the Bidder offers to perform the Work in a particular trade or other category, which is described in the Contract Documents, excluding Alternates.

23.1.12. Basis of Design

A. A document that records the concepts, calculations, decisions, and product selections used to meet CMHA’s Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines.

B. The document includes both narrative descriptions and lists of individual items that support the design process.

23.1.13. Basis of Design Component

A. A component listed first in the Specifications.

23.1.14. Bid

A. The written offer of a Bidder submitted on the prescribed CMHA Bid Form setting forth the prices for the Work to be performed.

23.1.15. Bidder

A. The person that submits a Bid.

23.1.16. Bid Form

A. A form furnished by CMHA with the proposed Contract Documents that is to be completed, signed, and submitted containing the Bidder's Bid.

23.1.17. Bid Guaranty

A. A bid bond or other instrument of security authorized by 24 CFR submitted with the Bid to provide assurance that the Bidder will execute the Agreement.

23.1.18. Bond

A. Bid, performance and payment bonds and other instruments of security submitted by the Contractor to assure that the Contractor will perform the Work of the Contract, including making payment to Subcontractors and Material Suppliers.

23.1.19. Building Information Model (BIM)

A. A digital representation of physical and functional characteristics of a facility and a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.

i. It describes the process of designing a building collaboratively using one coherent system of computer models rather than as separate sets of drawings.

23.1.20. Building Permit

A. The term building permit as used in the Contract Documents shall mean any and all permits required to comply with local and state building codes.

23.1.21. Certificate of Completion or Certificate of Contract Completion

A. A form, issued by CMHA, that documents the Contractors achievement of Contract Completion.

23.1.22. Certificate of Substantial Completion

A. A form, issued by CMHA, which is used to document:

i. That the Contractor has achieved Substantial Completion of the Work or a designated portion of the Work; and

ii. The date on which the associated Substantial Completion of the Work was achieved.

23.1.23. Change Order

A. A document recommended by the A/E and executed by CMHA and the Contractor that modifies the Contract and authorizes an addition, deletion, or revision in the work and an adjustment in the Contract Sum or the Contract Time or both.

23.1.24. Change Order Request

A. A CMHA prescribed form issued after execution of the Contract requesting a Change Order from the Contractor(s), which may initiate a Change Order to modify the Contract.

23.1.25. Claim

A. A demand or assertion, initiated by written notice as prescribe in the Contract Documents, by the Contractor or CMHA seeking an adjustment of Contract Sum or Contract Time or both, or other relief with respect to the terms of the Contract.

23.1.26. Claim Affidavit

A. A sworn document used in conjunction with filing a lien, which contains a claim on the funds that are due to a Contractor, in favor of a person supplying labor, materials or services for the value of labor, materials, or services supplied.

23.1.27. Construction

A. The term used to include new construction, reconstruction, renovation, restoration, rehabilitation, major repair, demolition and all similar work upon buildings and ancillary facilities, including any draining, dredging, grading or similar work upon real property.

23.1.28. Construction Progress Schedule

A. The critical path schedule for performance of the Contract; showing the time for completing the Work within the Contract Times; the planned sequence for performing the various components of the Work; the interrelationship between the activities of the Contractor, A/E, and CMHA; and the Contractor's resource and cost loading information; as periodically updated during the performance of the Work.

23.1.29. Contract

A. The contract entered into between the Contractor and CMHA.

B. It includes:

i. The Bid;
ii. The Bid Bond;
iii. The Performance and Payment Bond or Bonds or other assurance of completion;
iv. The Certifications, Representations, and Other Statements of Bidders;
v. The HUD General Conditions of the Contract for Construction;
vi. The CMHA Construction Contract General Terms and Conditions;
vii. The applicable wage rate determinations from the U.S. Department of Labor;
viii. Any special conditions included elsewhere in the contract;
ix. The specifications; and
x. Drawings

C. It includes all formal changes to any of those documents by addenda, Change Order or modification.

23.1.30. Contract Documents

A. Collectively, the documents that constitute the substance of the Contract including, but not limited to:

i. The Bid;
ii. The Bid Bond;
iii. The Performance and Payment Bond or Bonds or other assurance of completion;
iv. The Certifications, Representations, and Other Statements of Bidders;
v. The HUD General Conditions of the Contract for Construction;
vi. The CMHA Construction Contract General Terms and Conditions;
vii. The applicable wage rate determinations from the U.S. Department of Labor;
viii. Any special conditions included elsewhere in the contract;
ix. The specifications; and
x. Drawings

B. It includes all formal changes to any of those documents by addenda, Change Order or modification.

23.1.31. Contract Commencement Date

A. The date established in the Notice to Proceed issued by CMHA to the Contractor to mark the start of the Work and the beginning of the running of the Contract Time. If a Notice to Proceed is not issued, the Contract Commencement Date shall be the effective date of the Contract.

23.1.32. Contract Completion Date

A. The date by which the Work must be finally complete

B. The Contract Completion Date is established in Section 9.8 herein.

23.1.33. Contract Sum

A. The Contractor's entire compensation for the Contractor's proper, timely, and complete performance of the Work and is subject to adjustment as provided in the Contract.

23.1.34. Contract Time

A. The periods stipulated in the Agreement for the achievement of associated Milestones and Substantial Completion, in consecutive days, beginning on the date established by the Notice to Proceed, including adjustments authorized by executed Change Orders.

23.1.35. Contractor

A. The person or other entity entering into the Contract with CMHA to perform all of the work required under the Contract.

23.1.36. Contractor Payment Application Request

A. The form furnished by CMHA that is to be used by the Contractor in requesting payments and which, when signed by the Contractor, shall serve as an affidavit that payments requested are in proportion to the Work completed as shown on the Schedule of Values.

23.1.37. Contractor's Documents

A. All Project-related documents, including those in electronic form, prepared by the Contractor and its Subcontractors.

23.1.38. Contractor's Fee

A. The portion of the Contract Sum attributable to the aggregate of the Contractor's profit and home-office overhead related to the Contractor's proper, timely, and complete performance of the Work.

23.1.39. Contractor's Punch List

A. A document prepared by the Contractor that consists of a list of items of Work to be completed or corrected by the Contactor as a condition precedent to Contract Completion.

23.1.40. Coordination Drawings

A. Drawings and Electronic Files prepared by the Contractor to demonstrate how multiple-system and interdisciplinary work will be coordinated.

B. Clash reports generated by BIM authoring software may be included in the Coordination Drawing submittals if applicable.

23.1.41. Correction Period

A. A period of one-year commencing on the date of Substantial Completion of the Work or a designated portion of the Work which CMHA has agreed to take Partial Occupancy.

23.1.42. Day

A. A calendar day of twenty-four (24) hours measured from midnight to midnight, unless otherwise expressly specified to mean a business day.

23.1.43. Defective Work

A. Work that:

i. Does not conform to the Contract Documents;

ii. Does not meet the requirements of any applicable statute, rule or regulation, inspection, reference standard, test or approval;

iii. Has been damaged prior to the A/E's recommendation of final payment, unless responsibility for the protection thereof has been expressly assumed by CMHA; or

iv. That is not free from defects in workmanship, materials or equipment during the period of any warranty or guarantee

23.1.44. Differing Site Condition

A. Subsurface or latent physical conditions at the site which differ materially from those indicated in this Contract; or

B. Unknown physical conditions at the site(s), of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the Contract Documents.

23.1.45. Drawings

A. The drawings enumerated in the schedule of drawings contained in the Specifications and as described in the Contract Documents; and

B. Graphic portions of the Contract Documents, showing the design, type of construction, location, dimension, and character of the Work to be provided by the Contractor, which generally includes plans, elevations, sections, details, schedules, diagrams, notes, and text.

23.1.46. Electronic File

A. Information maintained in a computer system or format that is intended to facilitate a Person's use and manipulation of the information including but not limited to Word, Excel, PDF, Primavera, CAD, and BIM files all in their native format.

23.1.47. Enclosure, Permanent

A. The condition in which the permanent exterior walls and roofs are in place, insulated, weatherproof and weather-tight, and permanent windows and entrances are in place

23.1.48. Enclosure, Temporary

A. The condition in which the permanent exterior walls and roofs are in place, insulated, weatherproof and weather-tight, and windows and entrances are provided with suitable temporary enclosures

23.1.49. Estimated Construction Cost

A. The sum of the Estimated Contract Cost amounts published in the Solicitation, as modified by Addenda, for a phase of the Project.

23.1.50. Estimated Contract Cost

A. The estimated amount for the Contract published in the Solicitation, including the Base Bid estimate and the estimates of selected Alternates, if any, as modified by Addenda.

23.1.51. Extra Materials

A. Materials required by the Contract Documents that are not incorporated into the Project but are given to CMHA to be used for future maintenance or repairs.

23.1.52. Final Inspection

A. The final review of the Work of the Contractor by the A/E and CMHA to determine whether issuance of the Certificate of Contract Completion will be issued by CMHA.

23.1.53. Frivolous RFI

A. RFI's that request information that is evident in the Contract Documents and/or RFI's that do not comply with the definition of an RFI as indicated below.

23.1.54. General Conditions

A. CMHA's General Conditions currently in effect, which may be modified by the CMHA from time to time.

23.1.55. General Conditions Costs

A. General Conditions Costs include only the Contractor's costs to provide the general conditions Work including without limitation the costs of all of the following Site related items:

i. Scheduling and coordinating the Work;
ii. Telephone;
iii. Telephone charges;
iv. Facsimile;
v. Telegrams;
vi. Postage
vii. Photos
viii. Photocopying;
ix. Hand tools;
x. Simple scaffolds (one level high);
xi. Tool breakage;
xii. Tool repairs;
xiii. Tool replacement;
xiv. Tool blades;
xv. Tool bits; and
xvi. Pre-approved travel, lodging, and parking costs

B. General Conditions Costs also include:

i. Bond premiums; and
ii. Premiums for Builder's Risk insurance, if the Contractor is required to purchase Builder's Risk insurance policy for the Project.

23.1.56. Hazardous Materials

A. Any material, substance, pollutant, or contaminant that is defined, regulated, referenced, or classified in the Comprehensive Environmental Response, Compensation and Liability Act, Federal Water Pollution Control Act, the Resource Conservation and Recovery Act, Clean Air Act, Hazardous Materials Transportation Uniform Safety Act, Toxic Substances Control Act, or any other Applicable Law relating to any hazardous, toxic, or dangerous waste, substance, or material.

B. Any substance or material that, after release into the environment or upon exposure, ingestion, inhalation, or assimilation, either directly from the environment or directly by ingestion through food chains, will, or may reasonably be anticipated to, cause death, disease, behavior abnormalities, cancer or genetic abnormalities and specifically includes but is not limited to asbestos, polychlorinated biphenyls ("PCBs"), radioactive materials, including radon and naturally occurring radio nuclides, natural gas, natural gas liquids, liquefied natural gas, synthetic gas, oil, petroleum and petroleum-based derivatives and urea formaldehyde.

23.1.57. HUD

A. The United States of America acting through the Department of Housing and Urban Development including the Secretary, or any other person designated to act on its behalf.

B. HUD has agreed, subject to the provisions of an Annual Contributions Contract (ACC), to provide financial assistance to CMHA, which includes assistance in financing the work to be performed under this Contract.

C. As defined elsewhere in Contract Documents, the determination of HUD may be required to authorize changes in the work or for release of funds to CMHA for payment to the Contractor.

D. Notwithstanding HUD's role, nothing in this Contract shall be construed to create any contractual relationship between Contractor and HUD.

23.1.58. Indemnified Parties

A. CMHA, the A/E, other Separate Consultants, and their respective officials, officers, consultants, agents, representatives, and employees, in both individual and official capacities.

23.1.59. Install

A. Put into use or place in final position, complete and ready for intended service or use.

23.1.60. Liquidated Damages

A. A sum established in the Contract Documents, pursuant to the statutory delay forfeiture authorized under ORC and federal regulations, to be paid to CMHA due to the Contractor's failure to complete the Work within the Contract Time for achievement of Substantial Completion, or any applicable portion of the Work on or prior to any Milestone date stated on the Contract Documents.

23.1.61. Material Supplier

A. A Person under a contract with the Contractor to furnish materials or supplies in furtherance of the Work, including all such Persons in any tier.

B. Material Supplier does not include any Separate Contractor unless expressly assigned in writing to the Contractor by CMHA and accepted by the Contractor.

23.1.62. Milestone

A. A principal event specified in the Contract relating to an intermediate completion date or time prior to Substantial Completion of all Work.

23.1.63. Modification

A. A written amendment to the Contract signed by both parties;

B. A Change Order;

C. A Change Directive; or

D. An order for a minor change in the Work.

23.1.64. Notice of Commencement

A. A notice prepared by CMHA identifying the Project, the Contractors, the Surety for each Contractor, and the name CMHA's representative upon whom a Claim Affidavit may be served.

23.1.65. Notice of Intent to Award

A. A written notice provided by CMHA to the apparent successful Bidder stating that upon satisfactory compliance with all conditions precedent for execution of a Contract within the time specified CMHA intends to execute a Contract with the Bidder.

23.1.66. Notice to Proceed

A. A written notice provided by CMHA authorizing the Contractor to proceed with the Work and establishing the date(s) for commencement and completion of the Work.

23.1.67. ORC

A. The Ohio Revised Code.

23.1.68. Owner

A. The Cincinnati Metropolitan Housing Authority or its instrumentality or affiliate for whom the Project is being constructed.

23.1.69. Owner's Project Requirements

A. A written document that details the functional requirements of the Project and the expectations of how it will be used and operated

B. These include project goals, measureable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

23.1.70. Partial Occupancy

A. The condition that occurs when CMHA occupies or uses a portion of the Project prior to Contract Completion, partial occupancy is approved by authorities having jurisdiction, and items of Work cannot be completed until a subsequent date.

23.1.71. Person

A. An individual, corporation, business trust, estate, partnership, association, or other public or private entity.

23.1.72. Phase

A. A separation in the Work of the Project by sequence or time intervals, which may include separate contractors for each Phase.

23.1.73. Plan Holder

A. A prospective Bidder that received a set of Contract Documents prior to the bid opening.

23.1.74. Product Data

A. Manufacturer's standard illustrations, schedules, diagrams, performance charts, instructions, and brochures that illustrate physical appearance, size, and other characteristics of materials and equipment.

23.1.75. PHA

A. A Public Housing Authority which at all times shall mean the Cincinnati Metropolitan Housing Authority unless otherwise specified in the Contract Documents.

23.1.76. Project

A. The entire project, whether construction or rehabilitation, the work for which is provided for in whole or in part under the Contract Documents.

23.1.77. Project Manager

A. An employee of CMHA assigned to the Project and authorized to perform specific responsibilities.

B. A Project Manager may also be referred to as a Construction Manager or Construction Contract Administrator.

23.1.78. Project Record Documents

A. Electronic files and printed documents of all nature prepared by the A/E, which incorporate the information shown on the Contractor's As-Built Documents.

B. They consist of:

i. The "Record Drawings";
ii. Certificate of Substantial Completion;
iii. Certificate of Contract Completion (as complete);
iv. Contractor's Warranty;
v. Manufacturers' Warrantees, certificate(s) of occupancy, approved shop drawings and other action submittals;
vi. Proposal Requests;
vii. Requests for Interpretation;
viii. Addenda;
ix. Change Orders;
x. Balancing Reports; and
xi. The final version of the approved Construction Progress Schedule

23.1.79. Proposal

A. The offer of a Contractor to perform the Work set forth in a Proposal Request.

23.1.80. Provide

A. Furnish and install, complete and ready for intended use.

23.1.81. Punch List

A. A document listing items of Work requiring correction or completion by the Contractor as a condition precedent to Contract Completion.

23.1.82. Record Drawings

A. Synonymous to As-Build Drawings; and,

B. The Drawings, which have been revised by the A/E to show the changes made during the construction process, conformed to represent the Work as executed by the Contractor.

23.1.83. Request for Interpretation/Information (RFI)

A. A written request to CMHA or the A/E seeking an interpretation or clarification of the Contract Documents.

23.1.84. Samples

A. Physical examples, color selection items, field samples, and mock-ups furnished by the Contractor to illustrate functional and aesthetic characteristics of products, materials, equipment, or workmanship and establish criteria by which the Work shall be judged.

23.1.85. Schedule of Values

A. A full, accurate, and detailed statement furnished by the Contractor reflecting a defined breakdown of the Contract Sum.

23.1.86. Separate Consultant

A. A Person engaged by CMHA to provide Project-related professional services other than the services under this Contract.

B. The term includes the Separate Consultant's authorized representatives, successors, assigns, and sub-consultants regardless of tier.

23.1.87. Separate Contract

A. The contract between CMHA and a Separate Consultant or a Separate Contractor.

23.1.88. Separate Contractor

A. A Person under contract CMHA to provide Project related work other than the Work under this Contract.

B. The term includes the Separate Contractor's authorized representatives, successors, assigns, and subcontractors regardless of tier.

23.1.89. Shop Drawings

A. Drawings, diagrams, illustrations, and schedules specifically prepared for the Project provided by the Contractor or a Subcontractor to illustrate some portion of the Work.

B. Shop Drawings are not Contract Documents.

C. Shop Drawings on equipment shall include a written statement from the manufacturer of the equipment certifying the equipment is in compliance with the Contract Documents.

23.1.90. Site

A. The location designated for the Project.

23.1.91. Specifications

A. The written description of the technical requirements for construction and includes the criteria and tests for determining whether the requirements are met.

23.1.92. Stage

A. A distinct period in the life cycle of a facility from concept through construction, to use and deconstruction or demolition.

B. Typical Stages include Program Verification, Schematic Design, Design Development, Construction Documents, Bidding and Award stages; and the Construction, which includes Construction and Closeout activities.

23.1.93. Subcontract

A. Any contract or agreement between the Contractor and a Subcontractor for performance of a portion of the Work.

23.1.94. Subcontract Form

A. The Subcontract Form prescribed CMHA and required for use by Contractor when engaging Subcontractors.

23.1.95. Subcontractor

A. A Person who undertakes to perform any part of the Work on the Project under a contract with a Contractor or with any Person other than the State, including all such Persons in any tier.

B. The term "Subcontractor" includes Material Suppliers, but does not include any Separate Contractor unless expressly assigned in writing to the Contractor by CMHA and accepted by the Contractor.

23.1.96. Supplementary Conditions

A. Amendments to the CMHA Construction Contract General Terms and Conditions, issued as a separate document, prescribed by CMHA, which describes conditions of the Contract unique to a particular Project, which may include:

i. Provisions regarding the assignment of responsibility for refuse removal;

ii. Safety and security precautions and programs;

iii. Temporary Project facilities and utilities;

iv. Weather and fire protection;

v. Scaffolding and equipment;

vi. Materials and services to be used commonly by the Contractor and Subcontractors and requiring the Contractor to provide assistance in the utilization of any applicable equipment system;

vii. Preparation of operation and maintenance manuals; and

viii. Training of CMHA personnel for operation and maintenance of the Project

B. The CMHA Construction Contract General Terms and Conditions shall not be superseded or amended by Drawings and Specifications, unless so provided in Supplementary Conditions.

23.1.97. Surety

A. A Person providing a Bid Guaranty or a Bond to a Bidder or a Contractor, as applicable, to indemnify CMHA against all direct and consequential damages suffered by failure of the Bidder to execute the Contract, or of the Contractor to perform the Contract and to pay all lawful claims of Subcontractors, Material Suppliers and laborers, as applicable.

23.1.98. Substantial Completion

A. The stage in the progress of the Work when the Work (or designated portion of the Work for which CMHA has agreed to take Partial Occupancy) is sufficiently complete in accordance with the Contract that CMHA can utilize the Work for its intended use, as determined by CMHA.

B. The issuance of a certificate of occupancy or partial certificate of occupancy (if applicable) is a condition precedent to the achievement of Substantial Completion.

23.1.99. Substitution

A. An article, device, material, equipment, form of construction, or other item, proposed by a prospective Bidder prior to the bid opening and approved by the A/E by Addendum, for incorporation or use in the Work as being functionally and qualitatively equivalent to essential attributes of a Basis of Design or Acceptable Component specified in the proposed Contract Documents.

23.1.100. Unit Price

A. The cost of providing a unit of Work including labor, materials, services, and associated expenses.

23.1.101. Work

A. The labor, materials, workmanship, manufacture or fabrication of components, equipment, and services, individually or collectively which are required by the Contract Documents, to be performed, installed, or provided by the Contractor for the Project.

B. The furnishing of all material, labor, detailing, layout, supplies, plants, tools, scaffolding, transportation, temporary construction, superintendence, demolition, and all other services, facilities and items reasonably necessary for the full and proper performance and completion of the requirements of the Project as set forth in the Contract Documents, and items reasonably inferable therefrom and consistent therewith for the proper execution and completion of the construction and other services required by the Contract Documents, whether provided or to be provided by the Contractor or a Subcontractor, or any other entity for whom the Contractor is responsible, and whether or not performed or located on or off of the Site.

PARTICIPATION REPORT

MINORITY BUSINESS ENTERPRISE (MBE) WOMEN BUSINESS ENTERPRISE (WBE)

Contract / PO#: _____

Please list below the names of all firmly committed MBE and WBE subcontractors that will work on the project, their MBE/WBE Status, the dollar amount, and the percentage of total contract amount that will be performed by the entities. The MBE/WBE participation can include subcontracts or purchases of services, materials and supplies directly related to the contract.

(Please check one)_____Proposed_____Amended_____Final

	MBE	WBE	Name of Subcontractor(s)	Contract Amount $ Amount	% Percentage
1	☐	☐		$	%
2	☐	☐		$	%
3	☐	☐		$	%
4	☐	☐		$	%
5	☐	☐		$	%
6	☐	☐		$	%
7	☐	☐		$	%
8	☐	☐		$	%
9	☐	☐		$	%
10	☐	☐		$	%
11	☐	☐		$	%
12	☐	☐		$	%
			Total MBE Dollar Amount and Percentage of Contract	$	%
			Total WBE Dollar Amount and Percentage of Contract	$	%

Fill with legible block letters

Signature:_____

Contact Person: _____

Company Name: _____

Date: _____

S3 RESIDENTS AND BUSINESS CONCERNS

MINORITY BUSINESS ENTERPRISE (MBE) & WOMEN BUSINESS ENTERPRISE (WBE)

.

Prospective Business Vendor:
Section 3 is a provision of the Housing and Urban Development (HUD) Act of 1968 that helps foster local economic development, neighborhood economic improvement, and individual self- sufficiency. The Section 3 program requires that recipients of certain HUD financial assistance, to the greatest extent feasible, provide job training, employment, and contracting opportunities for low-or very low-income residents in connection with projects and activities in their neighborhoods.

Anyone claiming to be a Section 3 Business Concern shall be required, as set forth by procedure, to provide evidence of such status. Section 3 Business Concerns claiming Section 3 Preference status must meet that status at the time the bid, Bid or proposal is submitted to CMHA.

If you need any assistance or help regarding Section 3, feel free to contact us at Section3@cintimha.com

Section 3 Clause

A. The work to be performed under this contract is subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

B. The parties to this contract agree to comply with HUD's regulations in 24 CFR part 75, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 75 regulations.

C. The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notices shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

D. The contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 75, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 75. The contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 75.

E. The contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part75.9 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 75.9

F. Noncompliance with HUD's regulations in 24 CFR part 75 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.

G. In the event of a determination by the Executive Director or his/her designee that the Contractor is not in compliance with the section 3 clause or any rule, regulation, or report submission requirements of the CMHA, this contract may be canceled, terminated, or suspended in whole or in part, and the Contractor may be declared ineligible for further CMHA contracts for a period of one to three years.

H. Section 3. The work to be performed under this Agreement is subject to the requirements of Section 3. The Parties agree to comply with HUD's regulations in 24 C.F.R. part 75, which implement Section 3 and hereby certify to the best of their knowledge that they are under no contractual or other impediment that would prevent them from compliance. The Authority shall monitor the Developer's compliance from time to time during the Project. The Developer agrees to require all Subcontractors to the greatest extent feasible to comply with Section 3 and the regulations promulgated in 24 C.F.R. part 75, and agrees to take appropriate action upon a finding that the Subcontractor is in violation of the regulations in 24 C.F.R. part 75. The Developer will not contract with any Subcontractor where the Developer has notice or knowledge that the Subcontractor has been found in violation of the regulations in 24 C.F.R. part 75.

I. Number. The Developer agrees to meet the following Section 3 benchmarks of 25/5 (25% Section 3 Total Labor Hours / 5% Targeted Section 3 Total Labor Hours) and the stated percentages when selecting Subcontractors for the Project: (i) at least twenty percent (20%) of the general construction Subcontractors to qualify as a MBE Subcontractor; (ii) at least five percent (5%) of the general construction to qualify as a MBE Subcontractor (iii) at least ten percent (10%) of the construction contract Subcontractors to qualify as Section 3 Subcontractors. Additionally, any hiring or training opportunities generated should be provided to Section 3 and Targeted Section 3 workers to the greatest extent feasible. The list of proposed Subcontractors, including the MBE, WBE and Section 3 Subcontractors, shall be submitted to the Authority for approval prior to the Closing.

J. CMHA is committed to fostering neighborhood economic improvement and the self- sufficiency of its residents. This is done through taking proactive steps to hire local low- income persons and to award contractors to business that are registered Section 3 businesses. Therefore, CMHA strives to ensure that at least fifteen percent (15%) of all subcontracts are awarded to Section 3 businesses.

K. In accordance with the findings of the Congress, as stated in section 3, that other economic opportunities offer an effective means of empowering low-income persons, a recipient is encouraged to undertake efforts to provide to low-income persons economic opportunities other than training, employment, and contract awards, in connection with section 3 covered assistance.

L. The Developer shall require all Subcontractors to send to each labor organization or representatives of workers with which such Subcontractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the Developer's and/or Subcontractor's commitments under Section 3, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. Each Subcontractor shall certify to the Developer that any vacant employment positions, including training positions, that are filled (i) after a Subcontractor is selected but before the relevant contract is executed and (ii) with persons other than those to whom the regulations of 24 C.F.R. Part 75 require employment opportunities to be directed, were not filled to circumvent the Subcontractor's obligations under 24 C.F.R. Part 75 and the Developer shall certify to the Authority that it has obtained all suchcertifications.

M. With respect to work performed in connection with section 3 covered Indian housing assistance, section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e) also applies to the work to be performed under this contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this contract that are subject to the provisions of section 3 and section 7(b) agree to comply with section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).

Assurance of Compliance Training, Employment, and Contracting Opportunities

The project assisted under this contract is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 170u. Section 3 requires that to the greatest extent feasible, newly created opportunities that are generated by the awarding of this contract be given to:

- Section 3 Workers (25% minimum goal of labor hours) upon theirqualifications.
- Section 3 Targeted Workers (5% Minimum of laborhours)

Notwithstanding any other provision of this contract, the applicant shall carry out the provisions of said Section 3 and the regulations issued pursuant thereto by the Secretary set forth in 24 CFR Part 75, and all applicable rules and orders of the Secretary issued thereunder prior to the execution of this contract. The

requirements of said regulations include but are not limited to development and implementation of a Section 3 Action Plan/Strategy for utilizing Section 3 Business Concerns; the making of a good faith effort, as defined by the regulation, to provide training, employment and business opportunities required by Section 3; and incorporation of the "Section 3 Clause" specified by Section 75.9 and 75.17 of the regulations in all contracts for work in connection with the project. The applicant and recipient agency, certifies and agrees that it is under no contractual or other disability which would prevent it from complying with these requirements.

Compliance with the provision of Section 3, the regulations set forth in 24 CFR Part 75, and all applicable rules and orders of the Secretary issued thereunder prior to approval by the Government of the application of this contract, shall be a condition of the Federal financial assistance provided to the project, binding upon the applicant, its contractors and subcontractors, its successors, and assigns to the sanctions specified by the contract, and to such sanctions as are specified by 24 CFR Section 75.

Action Plan Submission
The Section 3 Action Plan is a requirement for contracting opportunities with CMHA. The Section 3 Action Plan must indicate/describe the proposed strategies for achieving the Section 3 training and/or employment goals, and subcontracting numerical goals, when and if newly created opportunities are generated upon awarding of contracts. Failure to submit the Section 3 Action plan may jeopardize the proposal/bid up to and including the possibility of said proposal/bid being deemed non-responsive.

Please review and complete the Section 3 Action Plan - Opportunities Strategies in the *Bid*. All Sections need to be completed. This information will help to assist you in formulating your Section 3 Action Plan. You will need to address each question and check the appropriate boxes in regards to how your company will strive to achieve Section 3 Compliance to the "greatest extent feasible". Please identify individual(s) responsible for planning, implementing and tracking the projects' Section 3 training, employment and/or contracting goals.

TO THE CINCINNATI METROPOLITAN HOUSING AUTHORITY (CMHA)

In submitting this Bid, I acknowledge that:

A. The Prevailing Wages shall be paid for a legal day's work to laborers, workmen or mechanics engaged in work under this Contract, at the site of the Project, in the trade or occupation listed.

B. The Wage Determinations provided shall be closely monitored by the contractor/bidder/Proposer for any modifications until the actual construction work begins locking in the wage determination for the duration of the contract. Wage determinations and modifications can be monitored and obtained at www.wdol.gov. Failure to include the current wage determination will not relieve the contractors of potential wageliabilities.

C. It shall be the Prime Contractor's responsibility to verify the accuracy of the reported wages, including his subcontractors.

D. It shall be the Contractors responsibility to be certain that all the classifications needed to accomplish the contract fall underneath one of the classifications listed on the Wage Determination provided in the scope of work.

E. In the event that a required classification is not listed, a contractor may submit a request for an additional classification. Remember the request is not valid unless the Department of Labor approves it. There will be no justification for an adjustment to a contract price due to an increased wage rate. The contractor should have been aware of any particular skilled trades that were not included in the original wage determination and thus accepted anyrisk that DOL would "conform" a pay rate higher than what they estimated when they priced their proposal. The contractor is responsible to propose wage/benefit rates that "bear a reasonable relationship" to the other classifications and rates listed on the wage determination.

F. The following pages are the Prevailing Rates of Wages as ascertained by the State or other Agency for thisProject.

G. Listed below is a checklist of items required for Wage and Hour Compliance.

H. Remember, prompt correction of deficiencies is essential. Failure to correct in a timely manner will be the withholding of payments on your contract until the deficiencies are corrected.

I. For your convenience listed below is a checklist of items required:

- □ Appointment of Paymaster
- □ Equal Employment Opportunity Affirmative Action Policy Statement *(EEOAAPS*)
- □ Equal Employment Opportunity Compliance Certificate (*EEOCC*)
- □ Letter of Understanding
- □ General and Subcontractors form (*if applicable*)
- □ Employment Utilization Report (*upon completion*)
- □ Section 3 Form (*if applicable*)
- □ Weekly certified payrolls that include:
  - □ Contractor's Name
  - □ Contractor's Address
  - □ Payroll #
  - □ Week Ending Date
  - □ Project and Location
  - □ Contract or Purchase Order No.
  - □ Name of Employee
  - □ Social Security Number
  - □ Address of Employee
  - □ No. of Exemptions
  - □ Work Classification
  - □ Calendar Days
  - □ Hours Worked
  - □ Total Hours
  - □ Rate of Pay
  - □ Gross Amount Earned
  - □ Taxes or Write 1099 across columns if employee files his own taxes
  - □ Statement of Compliance (back page of the payroll sheet)
  - □ One of the boxes checked indicating if fringes benefits are paid in cash or approved program
  - □ Contract's Signature Certifying Payroll

Fill with legible block letters

Signature:_____

Contact Person: _____

Company Name: _____

Date: _____

PART 1 ADMINISTRATIVE

1.1 GENERAL

A. Gold Standard

In 2012, CMHA established its Gold Performance Standards which consist of the principles and values by which the Agency performs and how our partners, vendors, contractors and consultants are measured.

The Gold Performance Standards are: Respect, Timely, Exceptional, Initiative, Excellent, Quality, Accurate, Integrity, Value, Creativity, Accountability and Professionalism. It's very imperative that our partners, vendors, contractors and consultants abide by these standards that has been establish.

B. CMHA's Vendor Registration

1. The Contractor shall register as a CMHA's Vendor if not one already. To complete CMHA's vendor registration packet visit www.cintimha.com under Business Opportunities / Vendor Registration.

C. Prevailing Wages

1. The Contractor is responsible to consider the Prevailing Wage determination. The Attached Wage Determination can be subject to change from the time of contractor walk through to the date the bid is due. Typically, the wage rates are updated/revised/modified on Friday's every week. To monitor the Wage Determination visit: www.wdol.gov

D. Permits

1. The Contractor Shall Obtain all necessary permits for construction activities in accordance with Federal, State and Local Jurisdiction.

E. Existing conditions

1. The contractor shall field verify all existing condition prior to quoting. Contractor is responsible to examine the job conditions and field measurement, distances, elevations, clearances, etc. and base their quote and work on verified conditions. No Change Order will be approved for modifications/alterations required to existing conditions that are

apparent on the drawings and specifications and visible during the walk through.

F. Drawings and Specifications

1. The Contractor is responsible for comprehending the specifications, plans and becoming familiar with the site location and performing/completing all the work in the specifications at high standards in a professional manner.
2. Drawings and specifications take precedence in case of conflict with this document.

G. Contract Management

1. The Contractor shall provide a Construction Schedule and all applicable insurances at the Pre-Construction meeting before starting construction.
2. The contractor shall furnish all labor, materials, tools, equipment and devices to complete the work as specified in scope of work.
3. The contractor is responsible pay all utilities during construction ie. electric power, natural gas and water. The contractor shall provide those not available on the property and needed for construction.

H. Site Management

1. The Contractor shall provide the Construction Project Manager and the Property Manager (PM) with 48-hour advance notice prior to the start of work.
2. The Unit will be

   X vacant during construction. ◯ occupied during construction.
3. The Building will be

   ◯ vacant during construction. X occupied during construction (1st floor).
4. Construction working hours are 8:00 a.m. - 4:00 p.m. Monday thru Friday. Weekend work is prohibited if not approved in writing.
5. The Contractor shall coordinate and cooperate with surrounding residents who currently reside in the houses and buildings to minimize conflicts. The contractor is fully responsible for properly securing the house at the end of the work day.
6. The Contractor shall keep areas under construction clean on a daily basis. All un-used construction material shall be removed from site at the end of each work day. The contractor is prohibited from using any dumpsters and/or totters that are on site. The contractor shall clean all areas that are affected by the renovation (i.e. mechanical room,

public walk ways, driveway, etc.)

7. The Contractor shall secure the construction site. The Contractor shall secure and protect all materials, tools and equipment stored on site and all work completed. CMHA assumes no liability for these material, tools and equipment that may become missing and/or damaged and not guarantees that the property's video surveillance captures the incident, if available.
8. The contractor may store materials, tools and equipment on site if approved in writing and as instructed by the owner.
9. The contractor shall have at least one person in charge and on site during the duration of the project. This person shall be familiar with the project scope and daily construction activities and other persons in the work area.
10. The contractor shall maintain all lawns/sites within the area contracted for the duration of the project. Lawns shall be cut a minimum of once every 10 days from March through October. The contractor shall also be responsible for the removal of all rubbish, debris limbs, leaves, etc., within the area.
11. The Contractor shall coordinate with owner location of barriers and separations as necessary to protect occupied areas from noise, dust or other disruptive activities.
12. The Contractor shall perform the work with a minimum of disruption by noise, odors, dust or other disruptive causes to owner's normal operations.
13. The contractor is responsible for any damages that may occur to the existing exterior and interior finish (i.e. landscaping, exterior façade, grass, concrete walks, asphalt/concrete paving, drywall, flooring materials, wall base, wall/door finishes, etc.) during the construction duration.
14. Protect all adjacent surfaces or finishes during all work. Restore affected surfaces if damaged during construction.
15. CMHA does not furnish janitorial supplies. However, the contractor is encouraged to contact the CMHA Materials Controls Department or Field Representative to get a list of janitorial products commonly used by CMHA.
16. The contractor is responsible for all trash and debris in the units, and in the front, sides

and rear yards.

I. End of Construction

1. The contractor is to submit an Operation and Maintenance manual at the end of the project, one hard copy and one digital copy in PDF format. The Operation and Maintenance manual shall include manufacturer manual and warranty of all equipment and/or devices used/purchased for this project.
2. The Contractor shall warranty all material and workmanship for a period of one year after acceptance.
3. The contractor shall perform all tests, adjustments, etc. as required by equipment manufacturer.
4. The Contractor shall perform all tests, adjustments, etc. as required on all new installed devices. The equipment and devices are to be 100% operable/functional after installation.

PART 2 CONTRACTOR RESPONSABILITIES

1. The Contractor shall:
   i. Verify quantities to successfully complete the project.
   ii. Coordinate with building operations and residents to minimize the interference of day to day activities.
   iii. Coordinate with building manager location of dumpster.
   iv. Coordinate with any other contractor working in the building. CMHA has several projects ongoing in this building.
   v. The contractor or any of its personnel shall not enter any unit, at any time. No exceptions.
   vi. Smoking is not permitted inside the building or its surrounding areas.
   vii. Keep all areas clean and free of debris during construction activities and after hours.
   viii. The contractor, subcontractors, material men, or suppliers shall use only unmanufactured articles, materials, and supplies that have been mined or produced in

the United States; and manufactured articles, materials, and supplies that have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured in the United States.

PART 3 MAKE READY PROCEDURES **X APPLY** **◯ DO NOT APPLY**

3.1 GENERAL (All units expect as noted)

A. Preparation and Finishing

2. Remove all hangers, hooks, mails, tape, contact paper, wall paper, borders, etc.
3. Remove any obvious imperfections in walls or ceilings.
4. Remove any imperfections around fixtures of any sort and outlets. Do not paint electrical fixtures, switches, outlets or cover plates.
5. Wipe debris off all surfaces. This includes but is not limited to webs, dust, dirt, insect eggs and feces.
6. Paint all walls, ceilings, doors, window sills, trim, etc.
7. Drywall should be prepped for level 4 drywall finish. This will require drywall to be skim coated to provide smooth finish prior to painting.
8. In the kitchen, wash all surfaces of excessive smoke or grease damage. Special care shall be given to cleaning the area behind the range and refrigerator.
9. Properly use drop clothes.
10. Remove excessive debris and dust from heat registers before painting them.
11. Caulk all edges of countertops, window frames, door frames, kitchen cabinets, the base of all walls that connect apartments and public spaces, etc.
12. Cleaning of paint and drywall utensils and tools of any kind are not permitted in the apartment unit(s).
13. The contractor shall inspect all surfaces requiring painting to verify the work has been completed before turning over the unit as PAINTED.
14. Paint to use:
    i. Primary wall paint: Promar 200 Interior Latex Eggshell, SW 7015
    ii. Bathroom paint: Promar 200 Interior Latex Semi-Gloss, SW 7015

iii. Ceiling paint: Promar 200 Interior Latex Flat, SW 7006

iv. Door and trim paint: Promar 200 Interior Latex Eggshell, SW 7006

3.2 MAINTENANCE (All units expect as noted)

A. Leaking Faucets

1. All faucets and toilets shall be operable and without leaks.
2. All drains shall be open and without leaking waste lines.
3. Laundry station(s) shall be operable, open and without leaks.

B. Windows

1. Clean all windows, doors, frames and seals, including front and back storm doors, and including handles and knobs. They should open, close and be able to lock.
2. Remove and repair any damage from any old hardware remaining from previous blinds and shades no longer in use.
3. Windows shall have vinyl 1" mini-blinds in working condition.
    i. All screens should be cleaned and in place without any rips or holes.
4. All missing screen shall receive new matching screens.

C. Doors

1. Make sure that all storm and prime doors are in place and operable (open, close and are able to lock).
2. All doors (interior, exterior, closets and cabinets) must be able to open and close properly without any missing hardware.
3. Replace or repair wheels, tracks, hardware, door knobs, etc. so that doors are operable and function properly.
4. Exterior Doors must be cleaned both on the inside and outside, including screen doors/storm doors.
5. Exterior doors must be painted as necessary.
6. Interior doors must be painted or shellacked as necessary.
7. Check door sweeps and weather stripping. Replace where needed.
8. Install doorstops throughout the unit.

9. Busted doors must be replaced. A busted door may consist of veneer coming off, excessive holes, cracks, or anything beyond repair. If the replacement of the door is in question, the property manager will have the final say in determining whether or not to replace it. It is the contractor's responsibility to ensure a proper fit within the frame, the holes are accurately drilled for hinges, door knob and lockset. Should the contractor damage the door during this process, they will be held financially responsible and/or required to replace the door with new like-kind door.
10. Do not paint door hardware, if painted previously paint must be removed.

D. Cover Plates

1. Replace (provide where missing) all cracked or damaged electrical/cable/telephone cover plates.
2. Do not paint cover plates.

E. Stair Treads

1. All stair treads shall be securely in place and without any cracks, chips, breaks or tripping hazards. No tripping hazards.
2. All stair treads must be cleaned thoroughly.

F. Electric Fixtures and Outlets

1. Clean all interior and exterior light fixtures, light shades, globes and switch plates and switches.
2. Fixtures shall be free of fingerprints, marks, dust and insects.
3. All switches shall be operable.
4. All outlets (including GFCI) shall be operable.
5. All exterior light fixtures, doorbells, etc. shall be operable.

G. Smoke Alarms/Detector

1. Remove all smoke alarms/detectors and install new per all applicable codes and regulations.
2. All smoke alarms/detectors should be properly installed and working.
3. Smoke alarms should not be painted or have stickers or other decorations present.
4. Smoke alarm/detector location guidelines

i. If mounted on the ceiling, it must be more than 4 inches from the wall.
ii. It cannot be closer than 4 inches or more than 12 inches from the ceiling if mounted on the wall.
iii. Smoke alarms should not be installed near windows, doors, or ducts where drafts might interfere with their operation.

H. Carbon Monoxide (CO) Alarms/Detector

1. Remove all smoke alarms/detectors and install new per all applicable codes and regulations.
2. Carbon Monoxide Detection shall be installed in dwelling units containing a fuel-burning appliance or fireplace.
3. Carbon Monoxide detection shall be included in any dwelling units with attached private garages.
4. Carbon Monoxide detectors shall be installed in dwelling units outside each sleeping area and within 10 ft. of the bedroom. If a fuel-burning appliance is installed in the bedroom, a CO detector must be installed in the bedroom.

I. LVT / VCT Floors

1. In locations where the floor tile terminates between rooms, provide a transition strip.
2. Remove/replace all damaged, missing and/or defective wood/vinyl baseboards, toe strips or transition strips.

J. Ceramic Tile

1. Replace any damaged drywall/green board behind ceramic wall tile.
2. Repair or replace any loose, broken or missing ceramic wall tile. Replace all loose, broken or missing grout (match existing). Remove/replace or provide caulk at all tub/ceramic tile locations that terminate at wall surfaces.

K. Water Heater(s)

1. Inspect water heater(s) for proper operation and exhaust venting. Report any problems to the Owner's Field Representative.
2. Furnace(s) and Boiler(s)

3. Inspect furnace(s) for proper operation and exhaust venting. Report any problems to the Owner's Field Representative.
4. Inspect boiler(s) for proper operation and exhaust venting. Report any problems to the Owner's Field Representative.
5. Inspect thermostat(s) for proper operation. Report any problems to the Owner's Field Representative.
6. Vacuum clean all heating and air conditioning equipment, grills, registers, etc. Report any problems (damaged or missing items) to the Owner's Field Representative.

L. Appliances

1. Range Hood – Inspect the range hood for proper operation (fan, light and exhaust venting if required). The hood should have all of its parts and hardware such as filters, knob, etc. Report any problems to the Owner's Field Representative.
2. Range and Refrigerator – The existing ranges and refrigerators on site shall be unwrapped and installed (put in place) and made ready for use (i.e. plugged-into outlet, connected to gas supply piping, etc.). Report any problems to the Owner's Field Representative.
3. Must operate properly with all parts and hardware on it.
4. Gaskets should seal properly
5. All lights must be working

M. Exterior and Unit Entry Doors

1. All doors must open and close securely. All doors shall have proper and functioning hardware. Report any problems to the Owner's Field Representative.
2. Inspect all doors for proper door sweeps and weather stripping. Remove/replace and/or provide new door sweeps and weather stripping where required.
3. Remove/replace and/or provide new door stops throughout all units.

N. Closets

1. Inspect all closets and verify the proper installation of shelving and clothes rods. If any are damaged or missing, report the information to the Owner's Field Representative.
2. Make sure all closet poles and shelves are installed.

3. Closets shall be cleaned and free of debris.

O. Stoppers/Strainers

1. Provide a stopper or strainer in every sink.

P. Bathroom Fixtures

1. Inspect all bathrooms to ensure that they have in place a soap dish, towel bars and a medicine cabinet. If any of these items are missing, report this information to the Owner's Field Representative.

Q. Bathroom, Laundry, and Kitchen Cabinetry

1. All elements should be inspected when evaluating cabinets, including doors, drawers, hinges, knobs, drawer guides or slides, shelves, and cases or boxes.

R. Caulking / Sealing of the Unit

1. Caulk where needed on counter tops, window frames, door frames, kitchen cabinets etc.
2. In apartments caulk the base of all walls that connect two units.
3. Caulk around breaker box.
4. IPM (Integrated Pest Management) practices must be followed:
5. Seal all openings, cracks, and voids where possible including but not limited to around conduits and pipes
6. Caulk all baseboards.
7. Caulk between kitchen cabinet trim and cabinets if your I.D. badge can slide between the trim and the cabinet.
8. Secure all loose material to prevent harborages (e.g., loose trim boards, loose hinges, uncaulked trim).
9. Clear silicone must be used inside all cabinets/drawers and where cove base/baseboard meets floor.
10. Paintable caulking must be used where cabinets meet wall and where cove base/baseboard meets wall.
11. All caulking color should match surrounding surface.
12. Any voids larger than ¼" cannot be caulked, additional support is needed, examples:
    i. ¼" round wood trim

ii. Luan board
iii. Expandable foam
iv. Expanded foam must be trimmed or sanded
v. Various types of wood trim
vi. Heat tape (range hoods).

S. Painting/Preparation and Finishing

1. Remove all hangers, hooks, nails, tape, contact paper, wallpaper, borders etc.
2. Take out any obvious imperfections in wall or ceilings.
3. Take out imperfections around fixtures of any sort and outlets.
4. DO NOT PAINT electrical fixtures, switches, outlets, cover plates, sprinkler heads, and escutcheon plates.
5. Remove debris and dust from within the heater registers and ductwork.
6. Use caulk where needed on counter tops, window frames, door frames, kitchen cabinet etc.
7. Inspect entire unit before you request approval for painting.

T. Painting

1. All painted surfaces will be repainted to provide a uniform finish and shall be free from runs. Work shall be performed in accordance with all the manufacturer's recommendations. The Contractor will be responsible for correcting at his/her expense any work not accepted by the Authority Staff.
2. Contractor shall scrape off all flaking and/or loose paint from ceiling, walls and trim, interior and exterior doors, and exterior windowsill surfaces. Where chipped paint exists, sanding will be performed by use of various grades of sandpaper to featheredge chipped areas to allow a smooth flow of paint and prevent further chipping.
3. Contractor shall perform surface preparation throughout unit on all walls and surfaces requiring painting for the application of paint; surfaces shall be prepared to be consistent with the existing surface. Contractor will paint the unit in accordance with the terms of this proposal and scope of work.

4. All nails, screws, brackets, debris, etc., shall be removed. All holes in the walls, ceilings, doors, trim, etc., as well as cracks, will be properly filled, floated or caulked flush with existing surface. Finish will match all other existing finish work.
5. All doors and window trim must be painted. DO NOT PAINT BUSTED DOORS. Busted doors must be replaced, previously described. Doors include but are not limited to interior, exterior, and screen doors.
6. Each unit shall include a painted accent wall in the living room.
7. If range hoods are currently painted, and range hood paint is peeling, flaking or bubbling, paint with heat-retardant paint, or replace range hood. DO NOT paint range hoods if not currently painted. Touch up any nicks or scrapes to appliances with appliance paint.
8. DO NOT paint electric boxes, breaker boxes, or cover plates unless previously painted.
9. Properly use drop cloths. Improper use could lead to termination of the contract and you will also be held liable for costs to restore floors, stairs, hardwood floors, VCT tile, ceramic tile, etc. Properly clean paint equipment and wall repair materials. Do not clean paint equipment in units. Protect all drains from clogging. Contractor may be held accountable for plumbing costs incurred due to Contractor's actions. DO NOT dispose of paint in trash chutes.

3.3 JANITORIAL (All units expect as noted)

A. Bathroom(s)

1. Clean ceramic tile walls and grout.
2. Clean ceramic tile floors and grout where applicable.
3. Clean and disinfect all bathroom fixtures including but not limited to: faucets, sink, toilet, bathtub, grab bars, knobs, medicine cabinet.

B. VCT Floors

1. Stripping Floors:
    i. Use buffer to strip tile floors.
    ii. Clean all corners under and/or around heat registers and vents.

iii. Clean baseboards and cove base.

2. Sealing/Waxing:
    i. Provide two coats of sealer and two coats of wax to the floors.

C. Carpet

1. Contractor shall furnish necessary equipment and materials/supplies to perform any carpet cleaning.
2. Contractor shall vacuum carpets both prior to and after cleaning carpets.
3. Carpet cleaning includes, but is not limited to, cleaning the carpet, spot treatment, moving furniture (if applicable), stain removal and carpet stretching (if required due to the water).

D. Wood floor

1. Clean wood floors and apply polyurethane.

E. Light Fixtures and Globes/Shades

1. Clean all light fixtures, light globes/shades, etc.

F. Windows/Frames and Doors/Frames

1. Clean all windows and frames.
2. Clean all doors and frame.

G. Kitchen

1. Stove
    i. Clean the outside of the stove with degreasing soap or all-purpose cleaner.
    ii. Use the degreaser or all-purpose cleaner on the knobs and handles as well.
    iii. Use oven cleaner for the inside of oven door, inside of broiler, the pan and the oven interior.
    iv. Clean drip pans and vent filters
    v. Clean range hood.
2. Walls
    i. Kitchen walls must be cleaned for excessive smoke or grease damage.
    ii. The area behind the range must be cleaned as well.
3. Refrigerator

i. Contractor shall defrost, clean and dry refrigerator.
ii. Clean refrigerator using an all-purpose cleaner or any other cleaner that does not harm coating or gaskets.
iii. Clean excess dust from bottom and rear coil of refrigerator.

4. Cabinets/Sinks/Countertops
   i. Clean all cabinets inside and outside.
   ii. Clean sink and countertops.
   iii. Cabinets, drawers and hinges shall be cleaned and free of debris.
5. Miscellaneous
   i. Clean the outside of water heater.
   ii. Contractors must ensure that units with basements are cleaned.
   iii. Pressure wash garages, both interior and exterior.

3.4 PROTECTION AND CAUTIONS

1. Protect all adjacent surfaces or finishes during all work. Restore affected surfaces if damaged during construction.

2. CMHA does not furnish janitorial supplies. However, the contractor is encouraged to contact the CMHA Materials Controls Department or Field Representative to get a list of janitorial products commonly used by CMHA.

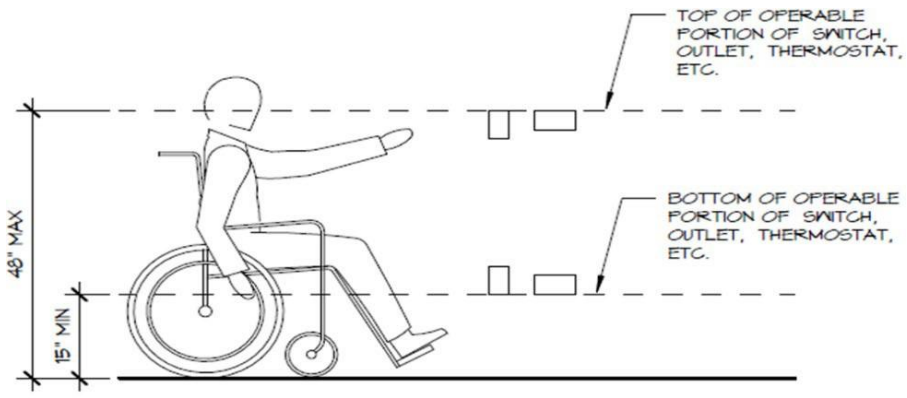
3. The contractor is responsible for all trash and debris in the units, and in the front, sides and rear yards.

PART 4 UFAS STANDARDS **X APPLY** ◯ **DO NOT APPLY.**

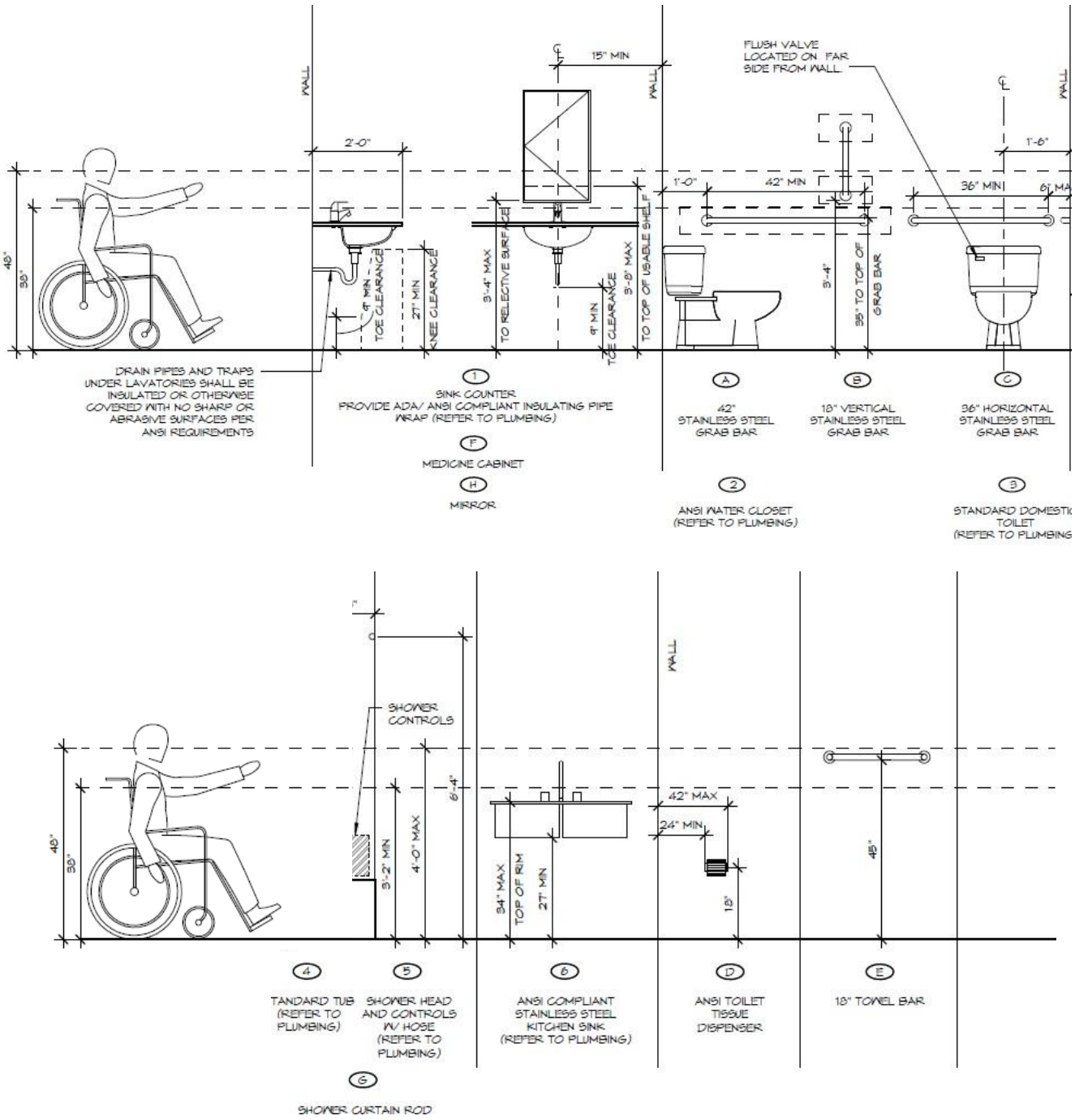
4.1 Follow all dimensions and clearances for American National Standard Institute (ANSI) ICC A117.1-2009 code compliance.

1. **Bathtub & Shower Controls:** Install controls within the space indicated.
2. **Sinks:** Install all bathroom sinks at or below, as approved, the maximum mounting heights and with floor clearances as indicated.
3. **Closets:** Install double hardware for shelving at 42” and 68”. Install shelf at 42”.

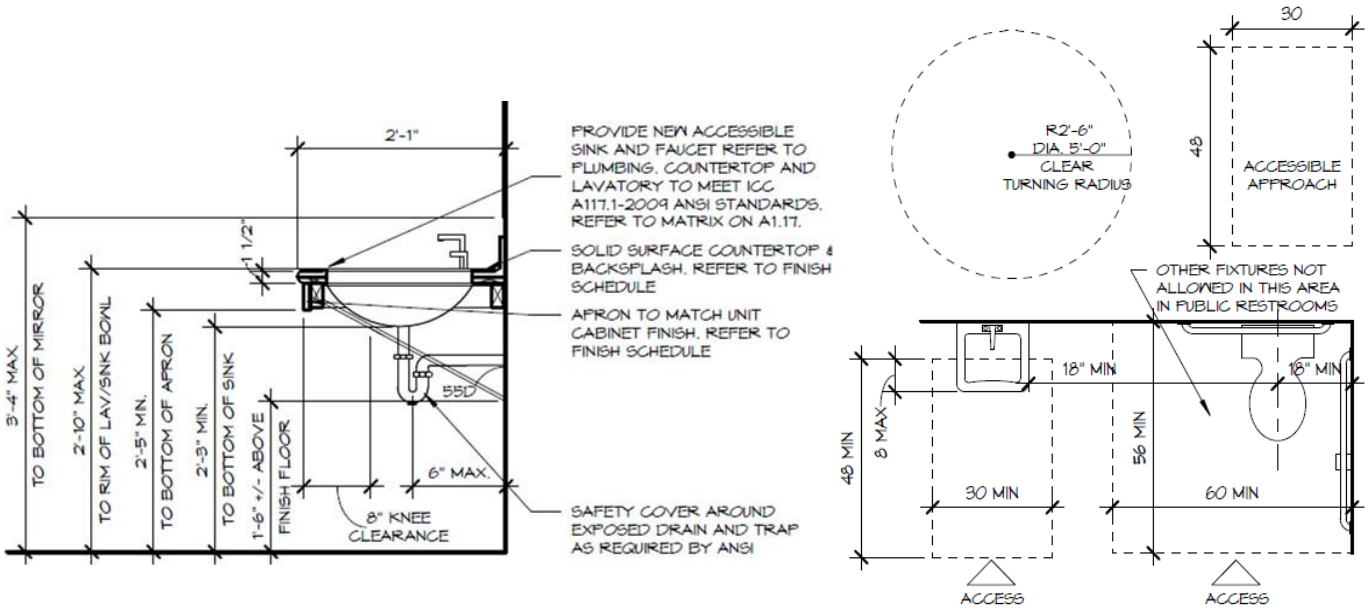
4. **Blocking for grab bar installation:** Install as indicated on detail. Blocking must be able to support 250 lb. of force applied to the grab bar.
5. **Controls outlets, switches, etc.:** Locate all controls, electrical panels, switches, receptacles and other operable equipment as indicted.
6. **Fixtures:** Mounting heights shall be as indicated.
7. **Kitchen Cabinets:** Install upper cabinets so that the lowest shelf is at a maximum of 48" A.F.F. The countertop height and the rim of the sink height shall be at a maximum of 34" A.F.F.
8. **Kitchen cabinet door pulls & handles:** Install Door pulls or handles for the upper cabinets as close as possible from the bottom of the cabinet door. Install Door pulls or handles for the lower cabinets as close as possible from the top of the cabinet door.
9. Mount all equipment's, fixtures, receptacles, outlets, switches, thermostats and controls as shown.
10. Diagrams below are not to scale.

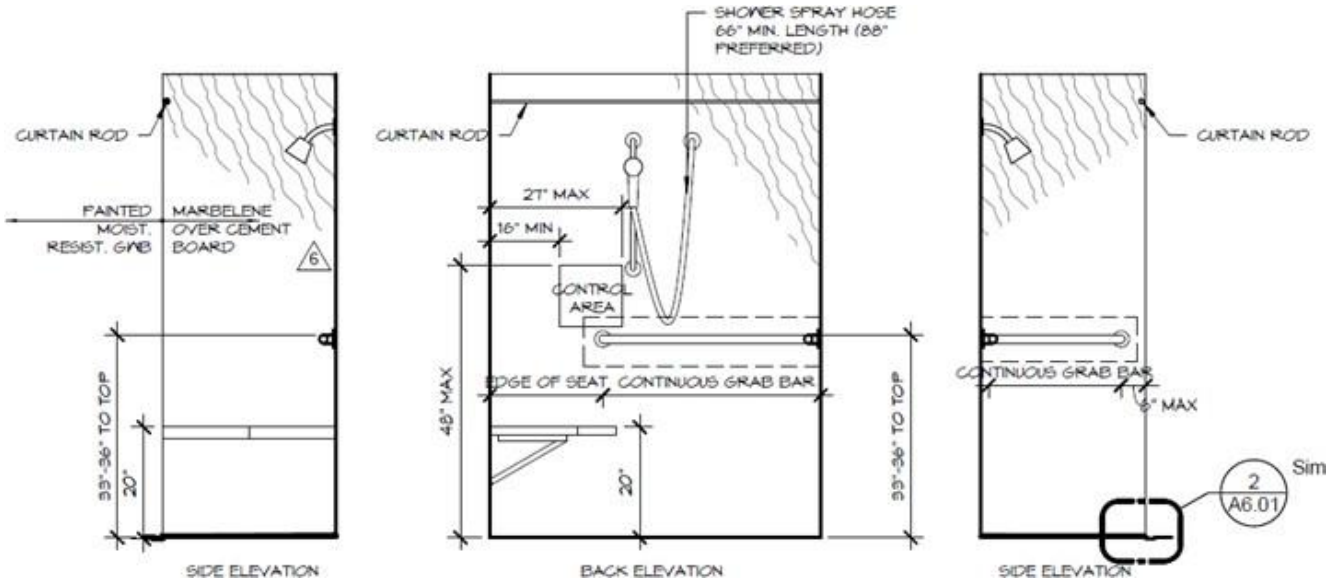


Reach Ranges

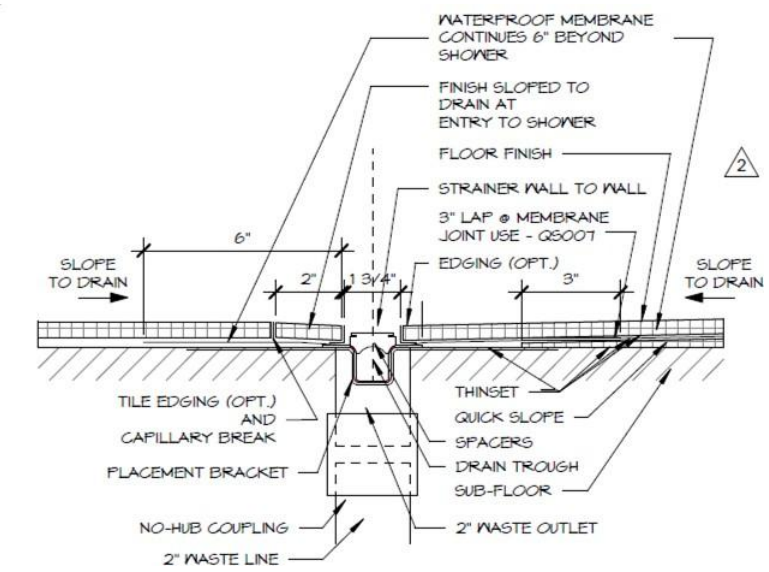


Bathroom Clearances

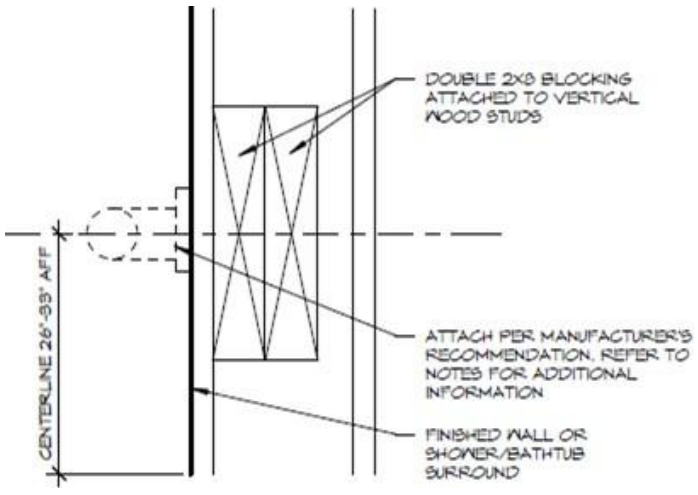




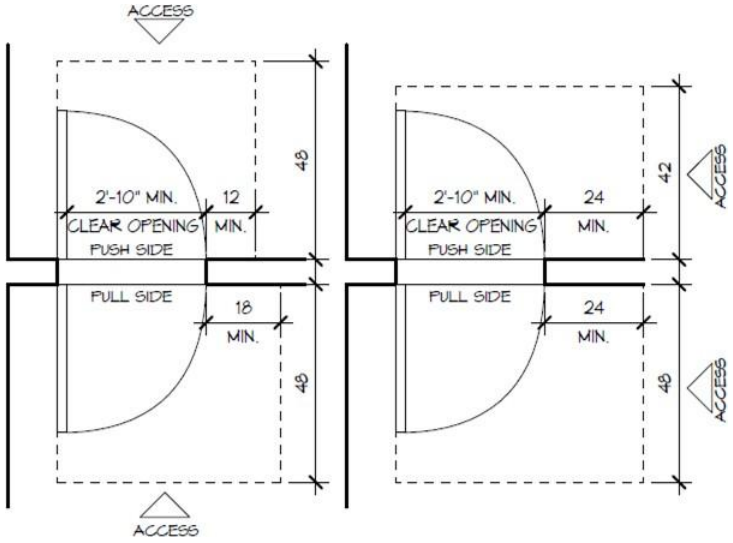
Bathroom Clearances



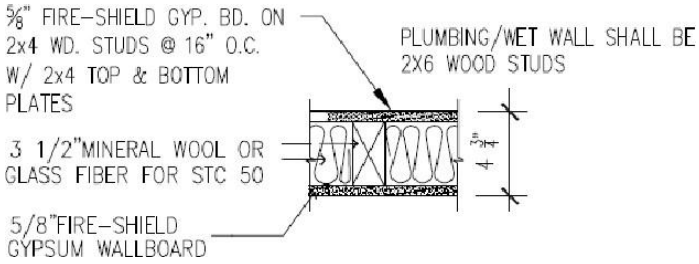
Shower Trench Detail



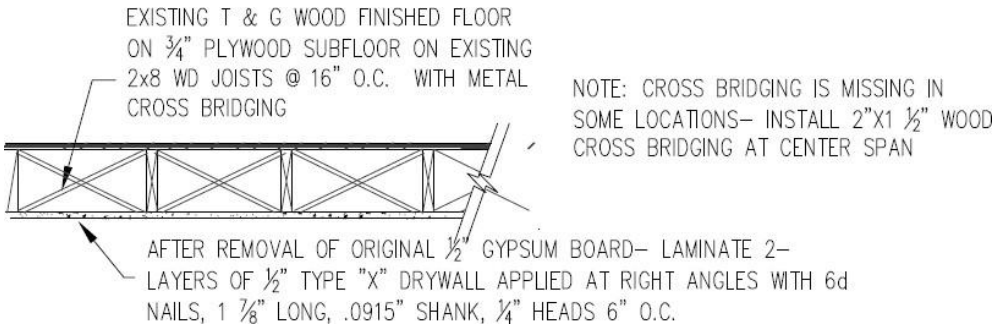
Grab Bar Blocking Detail



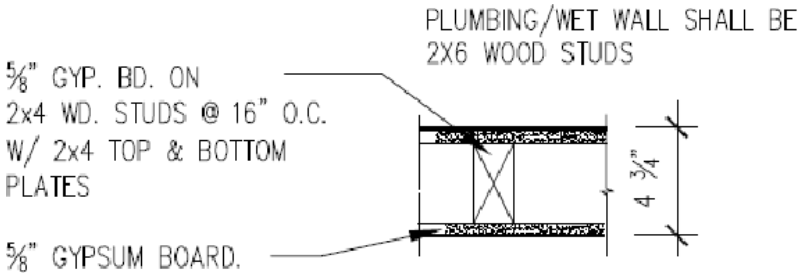
Door Clearances



WALL DETAIL 1 @ DEMISING WALLS / UL-U305 GA WP 3605 (1HR) STC35



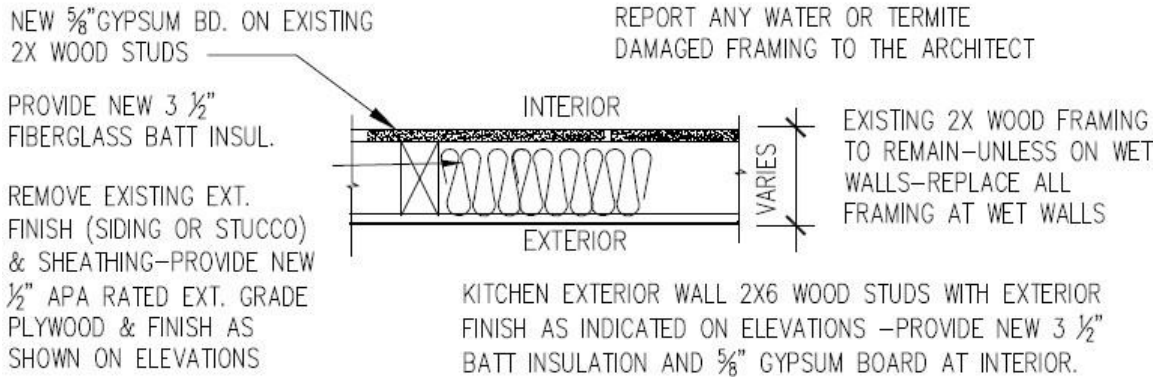
CEILING DETAIL 1



WALL DETAIL 2 @ INTERIOR WALLS

APPLY GYP. BD. EITHER HORIZONTALLY OR VERTICALLY. INNER LAYER ATTACHED TO STUDS W/ 1 7/8" NAILS @ 6" O.C.; OUTER LAYER ATTACHED TO STUDS OVER INNER LAYER W/ 2 3/8" LONG NAILS @ 8" O.C.. VERTICAL JOINTS LOCATED OVER STUDS. STAGGER ALL JOINTS IN FACE LAYER. NAILS 6 D CEMENT COATED NAILS.

NOTE: AT ALL PLUMBING WALLS- USE MOLD TOUGH FIRECORE TYPE "X" GYPSUM BOARD IN THICKNESS AS INDICATED FOR PARITION



WALL DETAIL 3 @ PERIMETER WALLS

Envisage
ARCHITECTURE

2. EXAMPLE CONTRACT

3244 Fairfield Ave ■ Cincinnati, OH 45207 ■ www.envisage-arch.com ■ 513.409.0609

AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

AGREEMENT made as of the 18th day of December in the year 2024
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

***Insert LLC name ***
1627 Western Ave.
Cincinnati, OH 45214

and the Contractor:
(Name, legal status, address and other information)

Insert Contractor name and address

for the following Project:
(Name, location and detailed description)

Insert Project name and address

The Architect:
(Name, legal status, address and other information)

Insert Project name and address

The Owner and Contractor agree as follows.

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT

DOCUMENTS EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[X] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

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[X] Not later than 420 (Four hundred and twenty) calendar days from the date of commencement of the Work.

By the following date:

[ ]

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

See Exhibit I: Unit Delivery Schedule and Liquidated Damages

Portion of Work	Substantial Completion Date

(Row deleted)

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be _____**words**_____ ($ _____), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price
None	

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.

(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:

(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:

(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

See Exhibit I: Unit Delivery and Liquidated Damages

§ 4.6 Other:

(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the 25th day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the 25th day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than forty-five (45) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Ten Percent (10.00%)

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§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

General Conditions, Builders Risk, Overhead, Profit and Bond

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

When at least Fifty Percent (50.00%) of the Work has been completed, (i) The Contractor may request that Fifty Percent (50.00%) of the amount retained on previous applications for payment be released by the Owner. 7.9.5. The Owner may, at its sole discretion, approve the request, effectively reducing the retainage from Ten Percent (10.00%) to Five Percent (5.00%) and (ii) the retainage for the balance of the work be reduced to Five Percent (5.00%). .

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located. *(Insert rate of interest agreed upon, if any.)*

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

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§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[X] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

Reema Ruberg, Treasurer
Insert LLC name 1627
Western Avenue
Cincinnati, OH 45214

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

***Insert Contractor
representative information***

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§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

(Paragraphs deleted)

.4 Drawings

Number	**Exhibit**
Drawing Log	Exhibit A

.5 Specifications

Section	**Exhibit**
Specifications Log	Exhibit B

.6 Addenda, if any:

Number	**Exhibit**
Schedule of Values	Exhibit C
Construction Schedule	Exhibit D
HUD Supplementary Conditions	Exhibit E
Section 3 Requirements Prevailing	Exhibit F
Wage Decision	Exhibit G
Const Contract Sales Tax Addendum	Exhibit H
Unit Delivery/Liquidated Damages	Exhibit I

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.7 Other Exhibits:

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(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

AJA Document E204Th'- 201 7, Sustainable Projects Exhibit. dated as indicated below:
(Insert the date of the £ 204-2017 incorporat4ed into this agreement)

The Sustainability Plan:

Title	Date	Pages

Supplementary and other Conditions of the Contract;

Document	Title	Date	Pages

.8 Other documents. if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreements. Any such documents should be listed here only if intended to be part of the Contract Documents.)

A201 2017

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*

_____

Insert LLC name

By: _____

(Printed and title)

CONTRACTOR *(Signature)*

_____

Insert Contractor Name

By: _____

(Printed and title)

Inlt.

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User Notes: (1803057258)

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

AJA Document E204Th'- 201 7, Sustainable Projects Exhibit. dated as indicated below:
(Insert the date of the £ 204-2017 incorporat4ed into this agreement)

The Sustainability Plan:

Title	Date	Pages

Supplementary and other Conditions of the Contract;

Document	Title	Date	Pages

.9 Other documents. if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreements. Any such documents should be listed here only if intended to be part of the Contract Documents.)

A201 2017

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*

_____

Insert LLC name

By: _____

(*Printed name and title)*

CONTRACTOR *(Signature)*

_____

Insert Contractor Name

By: _____

(*Printed name and title)*

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User Notes: (1803057258)

Additions and Deletions Report for
AIA® Document A101® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 15:08:41 ET on 12/11/2024.

PAGE 1

AGREEMENT made as of the _____day of _____in the year _____>

...

*** insert LLC name and address***

...

*** insert contract name and address***

...

*** insert project name and address***

...

*** insert architect name and address***

PAGE 2

[X] A date set forth in a notice to proceed issued by the Owner.

PAGE 3

[X] Not later than 420 (Four hundred and twenty) calendar days from the date of commencement of the Work.

...

See Exhibit I: Unit Delivery Schedule and Liquidated Damages

...

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...

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be _____($ _____), subject to additions and deductions as provided in the Contract Documents.

...

None

...

None

...

See Exhibit I: Unit Delivery and Liquidated Damages

PAGE 4

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the 25th day of the month, the Owner shall make payment of the amount certified to the Contractor not later than the 25th day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than forty five (45) days after the Architect receives the Application for Payment.

...

Ten Percent (10.00%)

PAGE 5

General Conditions, Builders Risk, Overhead, Profit and Bond

...

When at least Fifty Percent (50.00%) of the Work has been completed, (i) The Contractor may request that Fifty Percent (50.00%) of the amount retained on previous applications for payment be released by the Owner. 7.9.5. The Owner may, at its sole discretion, approve the request, effectively reducing the retainage from Ten Percent (10.00%) to Five Percent (5.00%) and (ii) the retainage for the balance of the work be reduced to Five Percent (5.00%). .

PAGE 6

[**X**] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

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PAGE 7

§ 8.6 Notic e in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with ~~a building information modeling exhibit,~~ AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with ~~a building information modeling exhibit,~~ AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

…

~~.4~~ ~~Building information modeling exhibit, dated as indicated below:~~
~~*(Insert the date of the building information modeling exhibit incorporated into this Agreement.)*~~

~~.5~~

.4 Drawings

~~Number~~	~~Title~~	~~Date~~

Number	**Exhibit**
Drawing Log	Exhibit A

~~.6~~ **.5** Specifications

~~Section~~	~~Title~~	~~Date~~	~~Pages~~

Section	**Exhibit**
Specifications Log	Exhibit B

~~.7~~ **.6** Addenda, if any:

~~Number~~	~~Date~~	~~Pages~~

Number	**Exhibit**
Schedule of Values	Exhibit C
Construction Schedule	Exhibit D
HUD Supplementary Conditions to the Construction Contract Section 3 Requirements Prevailing Wage Decision Construction Contract Sales Tax	Exhibit E Exhibit F Exhibit G Exhibit H
Unit Delivery/Liquidated Damages	Exhibit I

…

~~.8~~ **.7** Other Exhibits:

PAGE 8

~~.9~~ **.8** Other documents, if any, listed below:

…

A201 2017

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...

OWNER *(Signature)*

_____

Insert LLC name

CONTRACTOR *(Signature)*

_____

Insert Contractor Name

Certification of Document's Authenticity

A/A® *Document D401rn - 2003*

I. ***insert contractor representative name and title*** , hereby certify to the best of my knowledge, information a11d belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at ***insert date and time*** under Order No. 2114515930 from AJA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AJA" Document A101™- 2017. Standard Fonn of Agreement between Owner and Contractor where the basis of payment is a Stipulated Sum, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Titlte)

_____

(Date)

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User Holes: (l80305n58)

Bond No. 9468724

Document A312TM - 2010

Conforms with The American Institute of Architects AIA Document 312

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

Malling Address for Notices

This document has Important legal consequences. Consultation with an attorney Is encouraged with respect to Its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONSTRUCTION CONTRACT
Date:

Amount:_____

Description:
(Project Name and location)

BOND
Date: _____

(Not earlier than Construction Contract Dale)

Amount:_____

Modifications to this Bond: ( )None ( ) Sec Section 16

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

SURETY
Company: *(Corporate Seal)*

Signature:

Name
and Title:

Signature:

Name and Title:

(Any additional signatures appear on the las/ page of this Performance Bond.) (FOR INFORMATION ONLY - Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executor. administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the O\\11er, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five *(5)* business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall a\lend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable lime to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently lo declare a Contractor Default.

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies tl1e Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract

§ 4 F11ilure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ **5** When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ **5.1** Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract.

§ **5.2** Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors.

§ **5.3** Obtain bids or negotiated proposals from qualified contractors unacceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by U1c Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner ns a result of the Contractor Default; or

§ **6.4** Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surely does not proceed as provided in Section *5* with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional, written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled lo enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surely to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surely shall not be greater than those of the Owner under the Construction Contract. Subject lo the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract.
.2 additional legal, design professional and delay cost-; resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section *5;* and
. 3 - liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ **8** If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this I3ond.

§ **9** The Surely shall not be liable lo the Owner or others for obligations of the Contractor that arc unrelated to the Construction Contract, and the Balance of thc Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on U1is Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ **10** The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or wiU1in two years after the Contractor ceased working or wiU1in two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available lo sureties as a defense in the jurisdiction of the suit shall be applicable.

§ **12** Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ **13** When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was lo be perfom1ed, any provision in this Bond conflicting wiU1 said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payment made to or on behalf of fll1e Contractor under the Construction Contract.

§ **14.2** Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents Wld changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ **14.4 Owner Default** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to pcrfo1m and complete or comply with the other material terms of the Construction Contract.

§ **14.6** Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ **15** If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ **16** Modifications to this bond are as follows:
Multiple Obligee Rider Attached

(Space is provided below for additio11al signatures of added parties, other than those appearing on the cover ***page.)***

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*

Signan lre
Name and T-i-lle_:_____

Address

SURETY
Company: *(Corporate Seal)*

Signature: _
Name and Title:
Address

Bond No. -"-9_,_46=8 7=24 ----

MULTIPLE OBLIGEE
RIDER

WHEREAS, on or about the ____ day of _____ ,__ , _____
as Contractor, entered into a written agreement with
, as Obligee , for

the _____ herein referred to as the Contract; and

WHEREAS, the Contractor, as Principal, and the , executed and delivered to
said Contractor their joint and several Performance and Payment Bond; and

WHEREAS, the Obligee has requested the Contractor and Surety to join with the Obligee in the execution and delivery of this Rider, and the Contractor and Surety have agreed so to do upon the conditions herein stated.

NOW, THEREFORE, in consideration of One Dollar and other good and valuable considerations, receipt of which is hereby acknowledged, the undersigned hereby agree as follows:

The Performance and Payment Bond aforesaid shall be and it is hereby amended as follows :

I . The name of Allianz Life Insurance Company of North America ISAOA ATIMA; The Huntington National Bank ISAOA ATIMA; R4 Servicer LLC ISAOA ATIMA; R4 MMOH Acquisition LLC, ISAOA; R4 Capital LLC, ISAOA and Cincinnati Metropolitan Housing Authority shall be added to said Bond as a Named Obli gee.

2. There shall be no liability on the part of the Principal or Surety under this bond to the Obligees, or any of them, unless the Obligees, or any of them , shall make payments to the Principa l, or to the Surety in case it arranges for completion of the Contract upon default of the Principal, strictly in accordance with the terms of said Contract as to payments, and shall perform all the other obligations required to be performed under said Contract at the time and in the manner therein set forth.
3. Except as herein modified, said Performance and Payment Bond shall be and remain in full force and effect.

SIGNED, sealed and dated this day of

WITNESS OR ATTEST:

_____ (Seal)

Principal

_____

By _____

ZURICH AMERICAN INSURANCE COMPANY COLONIAL AMERICAN CASUALTY AND SURETY COMPANY FIDELITY AND DEPOSIT COMPANY OF MARYLAND POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the _____, a corporation of the State of _____, the _____, a corporation of the State of _____ , and the _____ a corporation of the State of _____(herein collectively called the "Companies"), by _____, in pursuance of authority granted by Article V, Section **8**, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby ce1tified to be in full force and effect on the date hereof; do hereby nominate , constitute, and appoint_____ all of _____, its true and lawful agent and Atto rney- in-Fact , to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: any and all bonds and undertakings, and the execution of such bonds or unde1takings in pursuance of these presents , shall be as binding upon said Companies , as fully and amply , to all intents and purposes , as if they had been duly executed and acknowledged by the regularly elected officers of the _____ at its office in _____., the regularly elected officers of the _____at its office in _____, and the regularly elected officers of the _____ at its office in _____, in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8 of the By-Laws of said Companies, and is now in force.

IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said _____ , this _____ day of _____ , A.D . _____.

ATTEST:

D

_____

By:

_____

By:

On this _____ day of _____, A.D. _____, before the subscriber, a Notary Public of the State of _____ , duly commissioned and qualified, _____of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument , and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

_____

Nota1)' Public

My Commission Expires _____

Authenticity of this bond can be confirmed at _____ or _____.

****Insert copy of the Bond*****

Exhibit A

*** Insert a copy of the Drawing Log ***

Exhibit B

*** Insert a copy of the Specification Index***

Exhibit C

*** Insert a copy of the Schedule of Values ***

Exhibit D

*** Insert a copy of the construction schedule ***

SUPPLEMENTARY CONDITIONS TO THE CONSTRUCTION CONTRACT

U.S. Department of Housing and Urban Development Office of Housing

OMB Approval No. 2502-0598
(Exp. 9/30/2021)

Public Reporting Burden for this collection of information is estimated to average 0.2 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Response to this request for information is required in order to receive the benefits to be derived. This agency may not collect this information, and you are not required to complete this form unless it displays a currently valid OMB control number. While no assurance of confidentiality is pledged to respondents, HUD generally discloses this data only in response to a Freedom of Information Act request.

Warning: Federal law provides that anyone who knowingly or willfully submits (or causes to submit) a document containing any false, fictitious, misleading, or fraudulent statement/certification or entry may be criminally prosecuted and may incur civil administrative liability. Penalties upon conviction can include a fine and imprisonment, as provided pursuant to applicable law, which includes, but is not limited to, 18 U.S.C. 1001, 1010, 1012; 31 U.S.C. 3729, 3802, 24 C.F.R. Parts 25, 28 and 30, and 2 C.F.R. Parts
180 and 2424.

Article 1: Labor Standards

A. **Applicability.** The Project or program to which the construction work covered by this Contract pertains is being assisted or insured by the United States of America, and the following Federal Labor Standards Provisions are included in this Contract or related instrument pursuant to the provisions applicable to such Federal assistance or insurance. Any statute or regulation contained herein shall also include any subsequent amendment or successor statute or regulation. The terms of this Supplementary Conditions to the Construction Contract (HUD-92554M) takes precedence over all provisions of the "General Conditions of the Contract for Construction" (AIA Document A201) inconsistent with said Supplementary Conditions.

B. **Minimum Wages.** Pursuant to Section 212 of the National Housing Act, as amended, 12 U.S.C. 1715c, the minimum wage provisions contained in this paragraph B do not apply to those projects with Security Instruments insured under Section 221(h)(1) designed for less than 9 families and they do not apply to those projects with Security Instruments insured under either Section 220 or 233 designed for less than 12 families.

1. (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the Project) shall be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1 (b)(2) of the Davis-Bacon Act (40 U.S.C. 3141(2)(B)(ii)) on behalf of laborers or mechanics are considered wages paid to such laborers or

mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(ii)) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii) (a) Any class of laborers or mechanics that is not listed in the wage determination and that is to be employed under this Contract shall be classified in conformance with the wage determination. HUD shall approve an additional classification and wage rate and fringe benefits only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, D.C. 20210 (**"Administrator"**). The Administrator, or an authorized representative, shall approve, modify, or disapprove every additional classification action within thirty (30) days of receipt and so advise HUD or its designee or shall notify HUD or its designee within the thirty (30) day period that additional time is necessary.

(c) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator for determination. The Administrator, or an authorized representative, shall issue a determination within thirty (30) days of receipt and so advise HUD or its

designee or shall notify HUD or its designee within the thirty (30) day period that additional time is necessary.

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs B.1.(ii)(b) or (c) of this Article, shall be paid to all workers performing work in the classification under this Contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the Contract for a class of laborers or mechanics includes a fringe benefit that is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. **Withholding.** HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this Contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis- Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the Contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the Project), all or part of the wages required by the Contract, HUD or its designee may, after written notice to the Contractor, sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the Contractor, disburse such amounts withheld for and on account of the Contractor or subcontractor to the respective employees to whom they are due.

3. Payrolls, records, and certifications.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the Project). Such records shall contain the name, address, and social security number of each such worker, his or her correct

classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section 1 (b)(2)(B) of the Davis-Bacon Act (40 U.S.C. 3141(2)(B)(ii))), daily and weekly number of hours worked, deductions made and actual wages paid.
Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1 (b)(2)(B) of the Davis- Bacon Act (40 U.S.C. 3141(2)(B)(ii)), the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(a) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to HUD or its designee if the agency is a party to the Contract, but if the agency is not such a party, the Contractor shall submit the payrolls to the applicant, sponsor, or Owner, as the case may be, for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired, whether paper (Optional Form WH- 347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/whd/forms/wh347.pdf or its successor site), or electronically pursuant to Program Obligations. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to HUD or its designee if the agency is a party to the Contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant sponsor, or Owner, as the case may be, for transmission to HUD or its designee, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this subparagraph for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to HUD or its designee.

(b) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or

supervises the payment of the persons employed under the Contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), and that such information is correct and complete.
(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the Contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in
29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the Contract.

(c) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph B.3.(ii)(b) of this Article.

(d) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Sections 3801 et seq of Title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under subparagraph B.3.(i) of this Article available for inspection, copying, or transcription by authorized representatives of HUD or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the Contractor, sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) **Apprentices.** Apprentices shall be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the
U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship, or with a State Apprenticeship Agency recognized by such Office, or if a person is employed in his or her first ninety (90) days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the

program, but who has been certified by the Office of Apprenticeship, or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where the Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship, or a State Apprenticeship Agency recognized by such Office, withdraws approval of an apprenticeship program, the Contractor shall no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) **Trainees.** Except as provided in 29 CFR 5.16, trainees shall not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman's hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on

the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor shall no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) **Equal employment opportunity.** The utilization of apprentices, trainees and journeymen under 29 CFR Part 5 shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. **Compliance with Copeland Act Requirements.** The Contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this Contract.

6. **Subcontracts.** The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraphs 1 through 10 of this paragraph B and such other clauses as HUD or its designee may by appropriate instructions require, and a copy of the applicable prevailing wage determination, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all Contract clauses referenced in this subparagraph.

7. **Contract termination and debarment.** A breach of the Contract clauses in 29 CFR 5.5 may be grounds for termination of the Contract, and for debarment as a contractor or a subcontractor as provided in 29 CFR 5.12.

8. **Compliance with Davis-Bacon and Related Act Requirements.** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this Contract.

9. **Disputes concerning labor standards.** Disputes arising out of the labor standards provisions of this Contract shall not be subject to the general disputes clause of this Contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and HUD or its designee, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this Contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act (40 U.S.C. 3144(b)(2)) or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(ii) No part of this Contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of Section 3(a) of the Davis-Bacon Act (40 U.S.C. 3144(b)(2)) or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001. Additionally, U.S. Criminal Code, Section 1010, Title 18, U.S.C., "Federal Housing Administration transactions", provides in part: "Whoever, for the purpose of . . . influencing in any way the action of such Department . . . makes, passes, utters or publishes any statement, knowing the same to be false . . . shall be fined under this title or imprisoned not more than two years, or both."

C. Contract Work Hours and Safety Standards Act.

1. **Applicability and Definitions.** This paragraph C of Article 1 is applicable only if a direct form of federal assistance is involved, such as Section 8, Section 202/811 Capital Advance, grants etc., and is applicable only where the prime contract is in an amount greater than $100,000. As used in this paragraph C, the terms "laborers" and "mechanics" include watchmen and guards.

2. **Overtime requirements.** No contractor or subcontractor contracting for any part of the Contract work that may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty (40) hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty (40) hours in such workweek.

3. **Violation; liability for unpaid wages; liquidated damages.** In the event of any violation of the immediately preceding subparagraph C.2, the Contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, the Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of such subparagraph, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty (40) hours without payment of the overtime wages required by the clause set forth in such subparagraph.

4. **Withholding for unpaid wages and liquidated damages.** HUD or its designee shall, upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract, or under any other Federal contract with the same prime contractor, or under any other Federally-assisted contract subject to the Contract Work

Hours and Safety Standards Act which is held by the same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph 3 of this paragraph C.

5. **Subcontracts.** The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraphs 1 through 5 of this paragraph C and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in such subparagraphs 1 through 5.

D. Certification.

For projects with Security Instruments insured under the National Housing Act, as amended, that are subject to paragraph B of this Article 1, the Contractor is required to execute the Contractor's Prevailing Wage Certificate within HUD-92448 as a condition precedent to insurance by HUD of the Loan, or an advance thereof, made or to be made by the Lender in connection with the construction of the Project.

Article 2: Equal Employment Opportunity

A. **Applicability.** This Article 2 applies to any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee.

B. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, disability, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, disability or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided setting forth the provisions of this nondiscrimination clause.

C. The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor state that all qualified applicants shall receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, disability, or national origin.

D. The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding a

notice to be provided advising the said labor union or workers representatives of the Contractor's commitments hereunder, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

E. The Contractor shall comply with all provisions of Executive Order 11246 of September 24, 1965 and of the rules, regulations, and relevant orders of the Secretary of Labor.

F. The Contractor shall furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and shall permit access to its books, records, and accounts by the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

G. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and Contractor may be declared ineligible for further government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulations or order of the Secretary of Labor, or as otherwise provided by law.

H. The Contractor shall include the provisions of paragraphs A through H of this Article 2 in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions shall be binding upon each subcontractor or vendor. The Contractor shall take such action with respect to any subcontract or purchase order as HUD or the Secretary of Labor may direct as a means of enforcing such provisions, including sanctions for noncompliance. *Provided, however,* that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by HUD or the Secretary of Labor, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

Article 3: Equal Opportunity for Businesses and Lower Income Persons Located Within the Project Area

A. This Article 3 is applicable to projects covered by Section 3, as defined in 24 CFR Part 135.

B. The work to be performed under this Contract is on a project assisted under a program providing Federal financial assistance from HUD and is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u. Section 3 requires that to the greatest extent feasible opportunities for training and employment be given to low and very-low income residents of the unit of local government or the metropolitan area (or non-metropolitan county) as determined by HUD in which the Project is located and contracts for work in connection with the Project be awarded to business concerns which are located in, or owned in substantial part by persons residing in the same metropolitan area (or non- metropolitan county) as the Project.

Article 4: Health and Safety

A. This Article 4 is applicable only where the prime contract is in an amount greater than $100,000.

B. No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his or her health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

C. The Contractor shall comply with all regulations issued by the Secretary of Labor pursuant to 29 CFR Part 1926, and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act, 40 USC 3701 et seq.

D. The Contractor shall include the provisions of this Article 4 in every subcontract so that such provisions shall be binding on each subcontractor. The Contractor shall take such action with respect to any subcontract as HUD or the Secretary of Labor shall direct as a means of enforcing such provisions.

Exhibit F

Section 3 requirements

Insert project name is subject to the requirements of Section 3. The Parties agree to comply with HUD's regulations in 24 C.F.R. part 75, which implement Section 3 and hereby certify to the best of their knowledge that they are under no contractual or other impediment that would prevent them from compliance. The Authority shall monitor the Contractor's compliance periodically during the Project. The Contractor will, to the greatest extend feasible, meet the benchmarks set by HUD. The Contractor agrees to require all Subcontractors to the greatest extent feasible to comply with Section 3 and the regulations promulgated in 24 C.F.R. part 75, and agrees to take appropriate action upon a finding that the Subcontractor is in violation of the regulations in 24 C.F.R. part 75. The Contractor will not contract with any Subcontractor where the Contractor has notice or knowledge that the Subcontractor has been found in violation of the regulations in 24 C.F.R. part 75.

A. The work to be performed under this contract is subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

B. The parties to this contract agree to comply with HUD's regulations in 24 CFR part 75, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 75 regulations.

C. The Contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

D. The Contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 75, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 75. The Contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 75.

E. The Contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the Contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 75.9 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 75.9.

F. Noncompliance with HUD's regulations in 24 CFR part 75 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.

G. With respect to work performed in connection with section 3 covered Indian housing assistance, section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e) also applies to the work to be performed under this contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this contract that are subject to the provisions of section 3 and section 7(b) agree to comply with section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).

Exhibit G

Insert Wage Decision*

Exhibit H

SALES TAX ADDENDUM TO

_____ CONSTRUCTION CONTRACT

1. Contractor acknowledges that the Cincinnati Metropolitan Housing Authority (the "Authority") is the owner, title holder and landlord of certain property in Cincinnati, Ohio located at _____ (the "Improvements"), and _____ LLC ("_____ LLC"), the tenant, plans to develop and rehabilitate the Improvements in connection with the work included in this contract (the "Work").

2. For state law purposes and pursuant to the Lease Agreement between ____ LLC, as tenant, and Authority, as landlord, Authority is the fee title owner of the Improvements. Because the seventy-five (75)-year term of the Lease Agreement exceeds the expected useful and depreciable life of the Improvements and the benefits and burdens of ownership of the Improvements are transferred to ____ LLC, as tenant, under the terms and conditions of the Lease Agreement, the Improvements are deemed for federal, state and local income tax purposes as owned by ____ LLC under the Lease Agreement.

3. Contractor will indemnify the Authority to the same extent that it indemnifies ___ LLC. With respect to the Work, and solely to the extent necessary to effect such indemnity, Contractor hereby expressly and specifically waives any defenses it may have to the application of or liability under such indemnity by way of Section 35, Article II of the Ohio Constitution and Section 4123.74 of the Ohio Revised Code, as well as any other similar immunity provided for or by any statute, law or constitutional provision of the State of Ohio and of any other applicable state. This covenant shall survive the termination of this contract.

4. Contractor acknowledges that the Authority is not and shall not be obligated to use any money or assets in connection with the Work or to satisfy any duties, obligations, requirements or liabilities whatsoever under this contract. The Contractor irrevocably acknowledges and agrees that it will look solely to ____ LLC for the payment of any additional amounts due or allegedly due under this contract, and that it will not assert or bring any claim against the Authority with respect to any such amounts.

5. Contractor represents and warrants to ___ LLC and Authority that it is and will remain in compliance and, upon request, will provide to ___ LLC appropriate statements or affidavits (and will procure the same from all subcontractors and provide them to ___ LLC) stating that it is in compliance with all legal requirements to be eligible to contract with the Authority, and that it is not aware of any finding for recovery having been issued against it by the Auditor of the State of Ohio which is "unresolved" under Section 9.24, Ohio Revised Code.

6. Contractor shall include the provisions of paragraphs 1 through 4 in all subcontracts that it issues (or contracts for the supply of materials to be used in the Work).

7. Contractor acknowledges that the Authority may be entitled to an Ohio sales and use tax exemption pursuant to Section 5739.02(B) of the Ohio Revised Code for building and construction materials or services incorporated into the real estate being improved by the Work

and the Contractor shall not pay any such Ohio sales or use tax to the extent that exemption is applicable, but only if ___ LLC has provided the Contractor with an appropriate certification (or copy thereof) signed by the Authority, evidencing the availability of such exemption. Contractor shall, and shall require all subcontractors and vendors to, retain copies of all records required under Section 5739.03 of the Ohio Revised Code in connection with the sales or use tax exemption for at least five (5) years after completion of the Work and shall provide those records to the Tax Commissioner of the State of Ohio upon request. This covenant shall survive the termination of this contract.

8. Contractor irrevocably acknowledges and agrees that the Authority has no financial responsibility with respect to the Improvements, and ___ LLC is responsible to pay all costs to construct the Improvements in accordance with the Lease, as defined in the Agreement.

9. Contractor acknowledges that the Authority is a third-party beneficiary to this agreement.

[End of Addendum]

Exhibit I: Unit Delivery and Liquidated Damages

In addition to achieving the Project Substantial Completion Deadline set forth in Article 3.3.2 of the Construction Contract, the Contractor understands, acknowledges and agrees that the Contractor shall also achieve Substantial Completion of its Work under the Contract Documents and delivered to the Owner by Building Floor Phases, which shall consist generally of a set of apartment dwelling units in proximity to each other on the same floor, with each successive Phase being in proximity to the one scheduled for completion immediately prior to it.

The Contractor shall achieve Project Substantial Completion by _____ or _____ days after notice to proceed, whichever is later and Contractor shall achieve Final Completion by _____or days after notice to proceed, whichever is later.

NTP date:

Phase	Apartments	Construction Completion Calendar Days After Notice to Proceed	Days for GC to finish	Date Units Available for Lease	Equity delivery requirement
1					
2					
3					
4					
5					
6					
7					

Owner to provide the Contractor the following vacant units as each phase progresses: _____
when preceding floor above is turned over for construction to allow for ADA improvements.

The Contractor acknowledges that it will be responsible for the construction of each Phase, as well as the overall planning, coordination and integration of the construction Work requested of the Contractor with respect to each Phase, so that each such Phase and the overall Project is integrated, completed, and coordinated in accordance with the Contract Documents.

The Contractor acknowledges and agrees that timely completion of the Work is the essence of the Contract Documents. Specifically, the Contractor acknowledges that the Owner will incur substantial damages if the dates for Substantial Completion of each Phase of the Work, all as set forth in the table above, and Project Substantial Completion are not met. Among other things, the Contractor acknowledges that in such events the Owner will incur additional financing costs (which in turn will reduce the Owner's equity in the Project), may be required to pay additional amounts to the Architect or other consultants and the Owner's own personnel for assistance on the Project and will suffer actual economic losses in the form of lost rental income and revenues, reduced equity, and operations costs that will not be recoverable by offsetting revenues from the Project's income.

Owner acknowledges the relocation of residents is their responsibility and dates and times set forth above assume Contractor will be provided an entire floor of vacant units. The Owner will work with the Contractor in order to complete the relocation as noted in each phase. Units must be turned over to the Contractor in reasonable condition, vacant, free of belongings and pests/bed bugs. If any units on the floor are not available due to fault of the Owner, Contractor shall provide written notice of unavailability to the Owner within forty eight (48) hours, and if Owner agrees that unavailability is due to fault of the Owner, those days lost plus 1 day will be added onto the phase schedule above.

Because the exact amount of these damages cannot be readily ascertained as of the date of this Contract, and because both the Owner and Contractor desire certainty with respect to their rights and obligations in the event the Project is not completed by the aforementioned date(s), the parties agree that if the Contractor fails to achieve Substantial Completion of each Phase of the Work and/or Final Completion of the entire Work by the dates established therefor, the Contract Sum shall be reduced, as agreed and as liquidated damages, by the following amounts (which shall be cumulative and have been based on a reasonable approximation of the Owner's damages in the event of such failure by Contractor):

(1) Two Hundred Dollars ($200.00) per calendar day that each Phase of the Work is not Substantially Complete beginning with the date established for Substantial Completion of each such Phase pursuant to table above, and continuing through the earlier of the date Substantial Completion of each such Phase is achieved or thirty (30) calendar days after the date established for Substantial Completion of each such Phase of the Work, but excluding delays attributable to Excused Delays.

(2) One Thousand Dollars ($1,000.00) per calendar day that each such Phase is not Substantially Complete beginning with the date that is thirty-one (31) calendar days after the date established for Substantial Completion of each such Phase pursuant to above, and continuing through the earlier of the date Substantial Completion of each such Phase is achieved or sixty (60) calendar days after the date established for Substantial Completion of each such Phase of the Work, but excluding delays attributable to Excused Delays.

(3) Two Thousand Dollars ($2,000.00) per calendar day that each such Phase is not Substantially Complete beginning with the date that is sixty-one (61) calendar days after the date established for Substantial Completion of each such Phase pursuant to above, and continuing through the date Substantial Completion of such Phase is achieved, but excluding delays attributable to Excused Delays.

(4) Five Hundred Dollars ($500.00) per calendar day for each such day that Project Substantial Completion is not achieved. The lesser of Liquidated Damages or Actual Damages shall be applied, but only with respect to Project Substantial Completion. All delays in achieving Substantial Completion of each Phase set forth in the above table shall be governed by Liquidated Damages set forth above, and not Actual Damages.

LABOR STANDARD PROVISION

All laborers and mechanics employed under this Contract in the construction of the project(s) involved will be paid unconditionally and not less weekly, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act, the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

The Contractor shall be fully responsible for the acts or omissions of its subcontractors and of the persons either directly or indirectly employed by them as for the acts or omissions of persons directly employed by Contractor. At all times throughout the Project, the Contractor is fully responsible for assuring each and every subcontractor performing work under this Contract pay its respective laborers and mechanics for such work the full amount of wages and bona fide fringe benefits under the correct prevailing wage rate for the work performed. The Contractor agrees to immediately notify the Owner if the Contractor or any subcontractor has not paid its respective laborers and mechanics for work under this Contract the full amount of wages and bona fide fringe benefits under the correct prevailing wage rate for the work performed. The Contractor further agrees to immediately notify the Owner if Contractor or subcontractor believes a general wage determination issued pursuant to 29 C.F.R. §1.5 is not available for work performed under this Contract. The Contractor shall insert the appropriate clause in all subcontracts to bind subcontractors to the terms and conditions of this contract insofar as they are applicable to the work of subcontractors.

Envisage
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3. F.F.E. BASIS OF DESIGN

3244 Fairfield Ave ■ Cincinnati, OH 45207 ■ www.envisage-arch.com ■ 513.409.0609

Envisage
ARCHITECTURE

Type of Finish	Match Ex'g	Company	Product/Model #	Collection	Name	Color	Rep Contact	Comments
Composite Interior WD Door	Match Ex'g							
WD Door Frame	Match Ex'g							
Window Sills/Trim	Match Ex'g							
Door Hardware								Refer to Hardware Schedule
LVT		Tarkett	11220	Event+	Heritage Plank PEHP	Hiroki Oak 2129	Greg Weldon 513-909-9033	
Floor Tile		Louisville Tile	WCX900052E-12X24	Wilcox 55	Flax	Beige	Kayla Malone 513-206-7557	
LVT to Tile Transition Strip		Schluter			Reno-U	Aluminum		
Thinset		TEC			TEC Ultimate 6 Plus			
Grout		TEC			TEC Power			
Wall Base - Rubber/Vinyl		Roppe	676	700 Series	Wall Base Pinnacle Type TS	676 Caribou	Scott Greiner 513-316-9800	
Stair Tread - Rubber/Vinyl		Roppe	676	700 Series	Wall Base Pinnacle Type TS	676 Caribou	Scott Greiner 513-316-9800	
High Contrast Nosing		Roppe	193	700 Series		193 Black Brown	Scott Greiner 513-316-9800	
Ceiling Paint		Sherwin Williams		Flat Finish		TBD		
Unit Wall Paint		Sherwin Williams		Promar 200 Interior Latex Eggshell		Repose Gray SW 7015		
Bathroom Wall Paint		Sherwin Williams		Promar 200 Interior Latex Semi-Gloss		Repose Gray SW 7015		
Stairwell Wall Paint		Sherwin Williams		Eggshell Finish		TBD		
Unit Entry Doors		Sherwin Williams		Semi-Gloss Finish		TBD		4 Accent Colors, Selection TBD
Interior Doors		Sherwin Williams		Semi-Gloss Finish		TBD		
Toilet		American Standard		Colony Pro				
Toilet Seat		Kohler			Quiet Close Toilet Seat			
Toilet Tank Lid	Match Ex'g							
Tub		Sterling	71171710-0		60in x 30in Soaking Bathtub with Left(Right) Drain in White	White		
Tub Surround		Delta	40154	Pro-Series	Pro-Series 60in W x 54in H Five Piece Glue Up Bathtub Surrounds	High Gloss White		
Shower Pan		Kohler	K8642		Rely 60" x 30" Alcove Shower Base	White		
Shower Head		American Standard		Colony Pro	Shower (Only)			Anti-Scald; Water Sense Required; Max. 1.5 GPM
Shower Control Valve + Escutcheon		American Standard						Anti-Scald
Tub Spout + Diverter		American Standard						
Shower Tub/Drain		American Standard						
Linear Shower Drain		American Standard						
Floor Drain		American Standard						
Lavatory Sink					Solid Surface			Refer to Drawings
Lavatory Faucet		American Standard		Colony Pro				Water Sense Required; Max. 1.5 GPM
Commercial - Sink Faucet		American Standard		Monterrey Gooseneck				Water Sense Required
Sink Drain Stopper		American Standard						
Kitchen Sink		Elkay		Lusterstone				
Kitchen Sink Faucet		American Standard		Colony Pro	Pull Down Faucet			Water Sense Required; Max. 1.5 GPM
Bathroom Mirror		Bradley	No. 781		Channel Frame Mirror 18" x 36"			
Medicine Cabinet		Bradley	9664					
Towel Bar 24"		Franklin Brass	D2424PC	Futura	Futura 24in Wall Mount Towel Bar Bath Hardware Accessory in Polished	Polished Chrome		
Towel Bar 18"		Franklin Brass	D2418PC	Futura	Futura 24in Wall Mount Towel Bar Bath Hardware Accessory in Polished	Polished Chrome		
Toilet Paper Holder		Franklin Brass	D2408PC	Futura	Futura 24in Wall Mount Towel Bar Bath Hardware Accessory in Polished	Polished Chrome		
Robe Hook		Bradley	9B1-1100	Elvari	Elvari Coat/Robe Hook	Satin Stainless P15-601		
Shower Curtain Rod		Bradley	9531					
Grab Bars 18"		Bradley	812					
Grab Bars 36"		Bradley	812					
Grab Bars 42"		Bradley	812					
Commercial - Paper Towel Dispenser		Bradley	No. 259					
Commercial - Toilet Paper Holder		Bradley	No. 505					
Commercial - Soap Dispenser		Staples	675289	Gojo TFX	Touch-Free Hand Soap Dispenser	Grey Plastic 2740-12		
Mailbox/Parcel Box		Salsbury	3504SSU	3500 Series	Vertical Mailbox - 4 Doors - Surface Mounted	Sandstone		
Awnings		Queen City Awnings						
Signage		Inpro		Savannah	Architectural Signage, Acrylic	Back: Black 0152; Face: Pebble Gray 0387; Text: Black 29920		Font: ADA Arial, Size: 6"H x 8"W
Wire Shelving	Match Ex'g							
Window Blinds					Aluminum Mini Blinds, Cordless	White		
Vanity Cabinetry		Smart Cabinetry	VS2D27		Vanity 2 Drawer Base Cabinets			
Kitchen Cabinetry		Smart Cabinetry		Dover	Veneer Flat Panel, Slab Drawer	Oak, Natural Stain		
Kitchen Cabinet Hardware		Hickory Hardware	HH075328-SS	Skylight	Modern Stainless Steel Bar Pull Handle for Kitchen, Bathroom, Furniture	Stainless Steel		Loop Pulls Required for ADA
Kitchen Cabinet Shelves	Match Ex'g				1/2" Melamine Cabinet Shelf w/ PVC Edge Banding + Support Pins	White		
Countertops - Solid Surface		Livingstone	L805		Solid Surface	Caldera		
Countertops - Laminate		Wilsonart	5044-60	Standard Laminate	Beachwalk, Fine Velvet Finish	Beachwalk		
Countertop Edge Banding + Adhesive	Match Ex'g							
Range		Amana	ACR4303MMS		4.8 cu.ft. 4 Burner Element Electric Range in white	Stainless Steel		
ADA Range		Whirlpool	W11508843A		Front Control Electric Range			
Range Hood		GE	JVX3300SJSS		Over the Range Convertible Hood	Stainless Steel		Recirculating, Hardwired, 50 CFM Min.
Refrigerator		Whirlpool	WRS312SNH		22 cu. Ft. Side-by-Side Refrigerator	Stainless Steel		Energy Star Rated
Dishwasher		GE	GDF460PGTSS		24in Buit-In Tall Tub Front Control White dishwasher w/ 60dba, Energy Star	Stainless Steel		Energy Star Rated
ADA Dishwasher		Whirlpool	W11562389A		Undercounter Dishwasher			Energy Star Rated
Disposal		Moen	GXP50C		Prep Series 1/2 HP Continuous Feed Garbage Disposal w/ Power Cord and Universal Mount			

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ARCHITECTURE

4. DESIGN DEVELOPMENT PRODUCT INFO

3244 Fairfield Ave ■ Cincinnati, OH 45207 ■ www.envisage-arch.com ■ 513.409.0609

SCS Global Services *does hereby certify that an independent assessment has been conducted on behalf of:*

Tarkett

30000 Aurora Road, Solon, Ohio 44139, United States

For the following product(s):

Vinyl Tile:
Arterra, Aura, Carrera, Color Play, Contour Abstract Series, Contour Wood Series, Contour Stone Series, Drop Cloth, Entwine, Factor, Fiber Effect, Hued, ID Latitude, Indigenous Earth , Intelocked, Melange, Meshwork, Mindset, Mirage, More Than a Wood, Parisian, Piemonte, Riot Flora Rio, Riot Flora Static, Square Flow, Transmatera, Digital Print Contour, True to Form Wood, True to Form Stone, Mindful Maker, Collaborative LVT, PM Square, Method, Victory Series, Ambienta, Solare, Injoy, Essence 30, Event Stone Series, Event Wood Series

floor score

CERTIFIED BY SCS Global Services

The product(s) meet(s) all of the necessary qualifications to be certified for the following claim(s):

FloorScore®

Indoor Air Quality Certified to SCS-105 v4.2-2023.

Conforms to the CDPH/EHLB Standard Method v1.2-2017 (California Section 01350), effective April 1, 2017, for the school classroom and private office parameters when modeled as Flooring.

Measured Concentration of Total Volatile Organic Compounds (TVOC): Less than/equal to 0.5 mg/m3 (in compliance with CDPH/EHLB Standard Method v1.2-2017)

ANAB
ANSI National Accreditation Board
ACCREDITED
ISO/IEC 17065
PRODUCT CERTIFICATION BODY

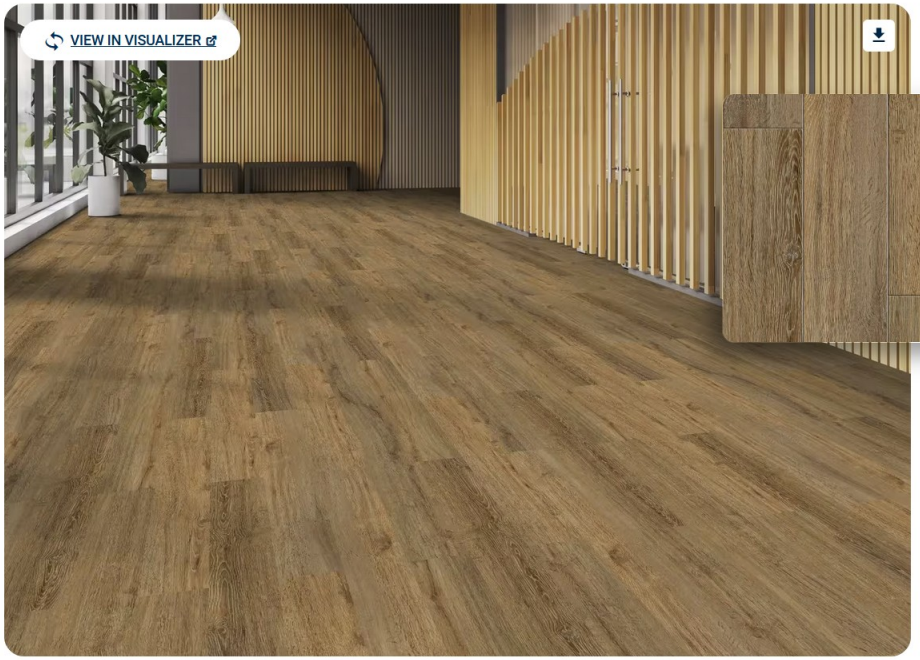
Registration # SCS-FS-01626

Valid from: July 01, 2024 to September 30, 2025

SCS Global Services is currently the only certification body approved by the Resilient Floor Covering Institute (RFCI) to provide FloorScore® product certification; certified products are only listed on the SCS Green Products Guide, http://www.scsglobalservices.com/certified-green-products-guide.

SCS global SERVICES

Diana Kirsanova Phillips, Chief Assurance Officer,
SCS Global Services



Event+ Wood

COLORS (30)



HIROKI OAK 2129

ORDER SAMPLES

CHECK INVENTORY

VIEW FORMATS, SIZES & THICKNESS

Plank (1)

COORDINATING STYLES (4)



Products | Resilient | LVT | Event+ Wood

Crafted Plank HIROKI OAK 2129

With a variety of grains and finishes in three style groupings—Classic, Crafted and Heritage—Event+ brings natural warmth and weathered character to commercial spaces. The Classic Plank style offers timeless, enduring visuals with rich, warm color and graining. Crafted Planks brings the look and feel of handcrafted artistry to a space. Heritage Planks feature the timeworn marks and aged patinas that add depth and historical character to weathered materials. Event+ Woods make beautiful statements on their own, or can be coordinated with the Stones and Abstracts in the rest of this versatile collection.

KEY FEATURES

- Choose from 30 Event+ Wood visuals
- 30 mil wear layer is suitable for areas with heavy traffic
- Best-in-class Techtonic™ protection against scratch, scuff, stain and abrasion

SUSTAINABILITY

SPECIFICATIONS

VIEW FULL SPECS

INSTALLATION & PACKAGING

TECHNICAL DOCUMENTS & IMAGES



WILCOX
FIFTY FIVE

FLAX

White | V2



12x24 Matte
WCXST36-12X24
WCXST36-12X24DEC

Beige | V2



12x24 Matte
WCXST37-12X24
WCXST37-12X24DEC

Light Grey | V2



12x24 Matte
WCXST38-12X24
WCXST38-12X24DEC

Dark Grey | V2



12x24 Matte
WCXST39-12X24
WCXST39-12X24DEC

Product Info

Size	Thickness	Product Type	PCS/ Carton	SF/ Carton	Cartons/ Pallet
12x24	8.5mm	Glazed Color Body Porcelain	9	17.01	32
12x24 Deco	8.5mm	Glazed Color Body Porcelain	9	17.01	32

Tech & Usage Info

DCOF	Scratch Hardness	Rectified	Residential	Commerical
≥ 0.50*	8 MOHS	Yes	Yes	Yes

**Matte Only*

**Ask your LTD sales rep for information on additional sizes and trim that may be available by special order.*

MADE IN THE USA



Ultimate 6 Plus Mortar

Updated February 2024

1. PRODUCT NAME

TEC® Ultimate 6 Plus Mortar
(487)

2. MANUFACTURER

H.B. Fuller Construction Products Inc.
1105 South Frontenac Street
Aurora, IL 60504-6451 U.S.A.
800.552.6225 Office
800.832.9023 Technical Support
800.952.2368 Fax
tecspecialty.com

3. DESCRIPTION

TEC Ultimate 6 Plus is a high performance, polymer-modified mortar designed for the installation of ceramic, porcelain and natural stone tile. Unlike other mortars, Ultimate 6 Plus has a unique combination of features that allow grouting in 6 hours while providing extended open time. It is ideal for all gauged porcelain tile panels/slabs and large heavy tile (LHT) installations. Ultimate 6 plus significantly reduces the need for back buttering and has exceptional non-sag / non-slump characteristics for wall and floor applications.

Key Features and Benefits

- Approved for all sizes of porcelain, ceramic and natural stone tiles
- Ideal for all gauged porcelain tile panels/slabs and LHT installations
- Approved for indoor glass applications with intermittent water exposure (see page 2)
- Approved for setting and tiling under and over uncoupling membranes
- Extended open time and pot life
- Accelerated set – grout in as little as 6 hours
- Superior transfer – full coverage with minimum effort
- Non-sag for wall applications and non-slump for floor applications
- Mixes to an extremely smooth, creamy consistency providing superior handling
- Exceeds ANSI A118.4HTE and A118.11 specifications
- Interior/exterior use
- Zero VOC

Packaging

40 lb. (18.14 kg) moisture-resistant bags	Product #15036116
40 lb. (18.14 kg) plastic bags	Product #15030010

Coverage

Coverage will vary with condition of substrate. Required trowel size will vary with the tile size, type and substrate uniformity. Select the trowel size that will ensure 100% coverage. Figures below are presented only as guidelines.

Trowel Size	Approximate Coverage per 40 lbs. (18.14 kg)
¼" x 3/16" (6 x 4.7 mm) V-notch trowel	182-204 sq. ft. (16.9-19.0 m²)
¼" x ¼" x ¼" (6 x 6 x 6 mm) square-notch trowel	91-102 sq. ft. (8.4-9.5 m²)
¼" x ⅜" x ¼" (6 x 9 x 6 mm) square-notch trowel	75-85 sq. ft. (7.0-7.9 m²)
⅜" x ⅜" x ⅜" (9 x 9 x 9 mm) square-notch trowel	60-68 sq. ft. (5.6-6.3 m²)
⅜" slant notch trowel	45-51 sq. ft. (4.2-4.7 m²)

In an effort to improve coverage achieved by installers, H.B. Fuller is not recommending the use of a ½" x ½" notch trowel due to the challenges in fully collapsing the ridges. In place, a ⅜" slant notch can be used. If using a ½" x ½" notch trowel, the coverage for a ⅜" slant notch is similar for material calculations.

Trowel Size	Approximate Coverage per 40 lbs. (18.14 kg)
¾" x 9/16" x ⅜" (19 x 14 x 9 mm) rounded-notch trowel	30-34 sq. ft. (2.8-3.2 m²)
Euro-notch trowel	26-33.5 sq. ft. (2.4-3.1 m²)*
¼" (6 mm) slant-notch trowel	25-30 sq. ft. (2.3-2.8 m²)*

*Based on application to both the substrate and tile back

Suitable Substrates

When properly prepared per TCNA guidelines, suitable substrates include:

- Cured concrete, cured mortar beds, brick and masonry (interior and exterior installations)
- APA Grade Trademarked Exposure 1 Plywood underlayment grade or better
- Gypsum wallboard (dry interior wall areas only)
- Water resistant gypsum wallboard (i.e.: greenboard, interior walls only, dry to intermittent water exposure only)
- Cementitious backer units (CBU) or glass mat backerboard
- Existing ceramic tile and natural stone, provided existing flooring is well-bonded to an approved substrate
- Vinyl composition tile, asphalt tile, linoleum or non-cushioned vinyl sheetgoods provided such surfaces are single layered, well-bonded to an approved substrate and properly prepared
- Adhesive residue (except tacky or pressure-sensitive adhesive). Mechanically remove the adhesive to expose at least 80% of the concrete surface. Random specks of adhesive and the appearance of a brown surface stain are acceptable
- Extruded foam waterproof tile board
- Uncoupling membranes

H.B. Fuller Construction Products Inc. ("HBF-CP") will warrant Ultimate 6 Plus with the use of ¾" floor-rated underlayment OSB as an approved substrate for the installation of uncoupling membranes.

For gypsum underlayments, TEC® Multipurpose Primer must be applied directly to the gypsum underlayments prior to application of Ultimate 6 Plus for bonding of the uncoupling membrane. Please see the Multipurpose Primer product data sheet for dilution ratios and application instructions.

Substrate Preparation

All substrates must be dry, structurally sound with maximum deflection per industry standards of L/360 for ceramic tile installations and L/720 for natural stone installations; and free from oil, grease, dust, paint, sealers or concrete curing compounds. All contaminants must be removed prior to installation of tile. Surface protrusions and tile glazes shall be removed by sanding, scraping or scarifying. After preparation, remove all dust by vacuuming.

For Gauged Porcelain Tile Panels/Slabs installation, reference the TEC® Thin Porcelain Panel Installation Guide on tecspecialty.com.

Notes: Vinyl asbestos tile or any substrate containing asbestos must not be sanded, scored or scarified because of the potential health hazard of breathing dust. Any substrate containing asbestos must be handled in accordance with existing EPA regulations. Contact your local EPA office.

Expansion joints must be provided in the tile work over all construction, control and expansion joints in the backing and where backing materials change. Follow ANSI A108.01 Section 3.7 Requirements for Expansion Joints.

Maximum variations in all substrates **must not exceed** 1/4" in 10 ft. (6 mm in 3 m) and 1/16" in 1 ft. (1.6 mm in 0.3 m) from the required plane for tile less than 15" (381 mm) on all sides. Maximum variations in all substrates **must not exceed** 1/8" in 10 ft. (3 mm in 3 m) and 1/16" in 2 ft. (1.6 mm in 0.6 m) from the required plane for tile 15" (381 mm) or greater on any one side. For large non-level, interior floors use an appropriate TEC Self-Leveling Underlayment.

For best results over plywood and other suitable porous substrates, wipe the surface clean with a damp sponge just prior to application of mortar.

The information in this product data sheet is valid for 90 days from the date listed above. Please visit www.tecspecialty.com/product-support to view or download the most current information.

Glass Tile Installation

Ultimate 6 plus, with its proprietary formulation, has been tested and approved to be used with glass tile for the following applications:

1. Indoor applications only
2. Wall applications only
3. Intermittent water exposure (not for use with submerged applications). Example such as:
   a. Kitchen Backsplash
   b. Shower wall

Note: When installing clear glass tile over waterproof membranes, visible mortar shadowing may occur.

The materials approved are as follow

1. Clear Glass tiles with no backing with maximum surface area of 16 in^2
2. Matted Mosaic Tiles with clear or painted Mesh backing
3. Matted Subway Tiles with Mesh backing
4. Glass tiles with painted backing up to 16 in^2

NOTE: Not all coatings used to colorize the back of glass tile are compatible with Portland cement based mortars. Please check with the manufacturer to determine if it will be compatible. For any questions on this, please call our Technical Support Hotline at 1-800-832-9023 for additional support.

Also, if you are looking to install a specific tile not listed in the above material list and would like to use Ultimate 6 Plus Mortar, please contact our Technical Support Hotline at 800-832-9023 for additional support.

In specifying a setting system for the bonding of glass tile, the following issues must be taken into consideration:

Glass Tile Type: Glass tile can be manufactured in a number of different ways such as clear, translucent with a colored body, or translucent with a colored backing. Each type has a different aesthetic appearance. The color and composition of the mortar can have an effect on the final appearance, especially with clear or translucent tile

Storage

Store in cool, dry location. Do not store open bags.

Shelf Life

Maximum 1 year from date of manufacture in properly stored, unopened package.

Limitations

- Only install when the ambient temperature is between 50-90ºF (10-32ºC).
- Not for installing green marble or other moisture-sensitive stone tile; use TEC® AccuColor EFX® Epoxy Grout and Mortar.
- For resin-backed marble see the TEC Technical Bulletin “Installation Of Resin Backed Stone Tiles” at tecspecialty.com.
- Not for use over rubber, strip wood floors, oriented strand board*, particle board, lauan plywood or tempered hardboard (e.g. Masonite).
- For CDX plywood, use TEC® Super Flex™ mortar or TEC® XtraFlex™ acrylic mortar additive with TEC® Full Set Plus® thin set mortar.
- Only approved for use over single layer wood floors when using uncoupling membranes per the manufacturer's requirements.
- Temperature of area to be tiled must remain above 50°F (10°C) for 72 hours.
- Certain natural stone tiles may be affected by mortar shadowing or staining. Test a small area prior to use to determine suitability.

*Can be used over OSB with the use of ¾" floor-rated underlayment OSB as an approved substrate for the installation of uncoupling membranes

Cautions

Read complete cautionary information printed on product container prior to use.
For medical emergency information, call 1-888-853-1758.

This Product Data Sheet has been prepared in good faith on the basis of information available at the time of publication. It is intended to provide users with information about and guidelines for the proper use and application of the covered TEC brand product(s) under normal environmental and working conditions. Because each project is different, H.B. Fuller Construction Products Inc. cannot be responsible for the consequences of variations in such conditions, or for unforeseen conditions.

4. TECHNICAL DATA

Applicable Standard

Exceeds ANSI A118.4HTE and A118.11 specifications

ISO 13007: Classification C2TEP1

TEC Ultimate 6 Plus (487)

Description	ANSI Requirement	Typical Results
28 Day Shear Strength Porcelain Quarry Tile	 > 200 psi (1.4 MPa) > 150 psi (1.0 MPa)	 480 psi (3.31 MPa) 400 psi (2.75 MPa)
7 Day Shear Strength Glazed Wall Tile	 > 300 psi (2.1 MPa)	 545 psi (3.75 MPa)
Sag on Vertical Surfaces	≤ 1/16" (1.6 mm)	0-1/32" (0-0.8 mm)
Open Time at Room Temperature	20 minutes	50-60 minutes
Adjustability at Room Temperature		30 minutes
Final Set		5-7 hours
Tested in accordance with ANSI A118.11 Specifications for Latex-Modified Dry Set Mortars over Exterior Grade Plywood		
28 Day Shear Strength Quarry Tile	 150 psi (1.0 MPa)	 205 psi (1.41 MPa)

Greater than: > Greater than or equal to: ≥ Less than: < Less than or equal to: ≤

Physical Properties

Description	
Physical State	Dry powder
Color	White
Pot Life	2-3 hours*
Initial Cure [at 72°F (22°C)]	6 hours*
Final Cure	21 days
Foot Traffic Rating (ASTM C627)	Residential to Extra Heavy Commercial (depending on substrate)
Storage	Store in cool, dry location. Do not store open bags.
Shelf Life	Maximum 1 year from date of manufacture in properly stored, unopened package.

*Temperature and humidity will affect pot life and cure time

5. INSTALLATION INSTRUCTIONS

Mixing

For best results, maintain all tiling materials, substrates, room and mortars at 50°-70°F (10-21°C) for 24 hours before and 48 hours after installation. In a clean mixing container, add TEC Ultimate 6 Plus to clean, cool water as specified in the chart.

Application	Water
LHT, Gauged Porcelain Tile Panels/Slabs or Wall Applications	6 to 6½ quarts (5.6 to 6.1 L)
Thin Set Floor Applications	6½ to 6¾ quarts (6.1 to 6.4 L)

Add 2/3 bag of TEC Ultimate 6 Plus and mix until all powder is consumed. Add final 1/3 bag and mix until powder is consumed. Be cautious not to over-water. Consistency will loosen during mixing process. Mix material for two (2) minutes to a smooth and creamy consistency. Avoid breathing dust and contact with eyes and skin. Allow the mortar to stand for 10 minutes. Remix and apply. Avoid using high speed mixing, not to exceed 300 rpm, to prevent entraining air.

Application

Key in mortar using flat side of trowel to promote better substrate contact, then comb in one direction with the notched side of the trowel. Spread only an area that can be tiled while surface is still tacky (typically 20-30 minutes). Press tiles into setting bed, then push in a direction perpendicular to the notched trowel ridges to achieve optimum coverage. Apply mortar in a heavy enough layer so that complete contact (no voids) between mortar

and tile is accomplished when tile is positioned. Irregularities in substrate may require "back-buttering" of large tiles to achieve complete coverage and firm support. Periodically remove and check a tile to assure proper coverage. Keep a minimum of ⅔ of the joint depth between tiles for grouting. Open time and tile hand adjustability may vary with job site conditions. Stir occasionally during use to maintain the smooth, creamy consistency of the product. **Do not add additional water.**

For Gauged Porcelain Tile Panels/Slabs installation, reference the TEC Thin Porcelain Panel Installation Guide on tecspecialty.com.

For resin backed tiles, use full strength TEC Multipurpose Primer on the back of the tile, let dry, then press the tile into the setting bed.

Note: It is the sole responsibility of the installer to determine the suitability and compatibility of the product for the intended application.

Clean-up

Clean tools, hands, and excess materials from face of tile, while mortar is still fresh, with warm soapy water.

Grouting/Curing

Grouting may be accomplished when tiles are held firmly in place, typically 6 hours after installation is completed. No traffic is permitted over the tiles prior to grouting. Cold temperatures or high humidity may extend curing time, working time, and pot life. Hot temperatures or low humidity may decrease curing time, working time, and pot life. Unglazed tiles may require sealing prior to grouting so discolorations will not occur. The use of TEC brand grouts is highly recommended.

6. AVAILABILITY

TEC premium surface preparation, tile, stone, carpet, wood and resilient floor covering installation products are available nationwide. To locate TEC products in your area, please contact:

Phone: 800-832-9002
Website: tecspecialty.com

7. LIMITED WARRANTY

The product(s) covered by this Product Data Sheet are sold subject to a Limited Warranty and related terms. **H.B. Fuller Construction Products disclaims the implied warranties of merchantability and fitness for a particular purpose and all incidental and consequential damages arising out of the sale, purchase or use of this product.** For Limited Warranty details visit tecspecialty.com. To obtain a hard copy of the Limited Warranty call H.B. Fuller Construction Products at 800-832-9023 or mail a written request to the address in Section 2 of this Product Data Sheet.

8. MAINTENANCE

Not applicable

9. TECHNICAL SERVICES

Technical and safety literature

To acquire technical and safety literature, please visit our website at tecspecialty.com.

10. FILING SYSTEM

Division 9

Conforms with LEED v4 low emitting interiors.
Compliant with (CDPH) Standard Method v1.2 VOC Emissions.



To learn more, visit TECspecialty.com

H.B. Fuller

H.B. Fuller Construction Products Inc. | 1105 South Frontenac Street Aurora, IL 60504-6451

@TECInstallationSystems tecinstallationsystems TECInstallationSystems TEC Installation Systems

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Power Grout®

Updated October 2023

1. PRODUCT NAME

TEC® Power Grout®
(550)

2. MANUFACTURER

H.B. Fuller Construction Products Inc.
1105 South Frontenac Street
Aurora, IL 60504-6451 U.S.A.
800.552.6225 Office
800.832.9023 Technical Support
800.952.2368 Fax
tecspecialty.com

3. DESCRIPTION

Power Grout is a unique breakthrough in grout technology. It maximizes performance while providing ease of use. Its unique formulation is stain proof* and provides strong, color consistent joints free of efflorescence that is resistant to shrinking and cracking.

Power Grout provides excellent performance in virtually any environment, including high traffic and wet conditions, and in residential and commercial applications.

Key Features and Benefits

- Stain proof* - never needs sealing
- Color uniformity and zero efflorescence
- Fast setting; open to traffic in 4 hours
- For grout joints from 1/16" to 1/2" wide (1.6 mm to 12 mm)
- Residential to Extra Heavy Commercial Applications
- Crack and shrink resistant
- Exceeds ANSI A118.7 specifications
- Interior/exterior use
- Mold and mildew resistant
- Contributes to LEED® project points
- Zero VOC

*Power Grout is stain proof to most common water based stains when cleaned immediately. The prolonged exposure of any stain will increase the likelihood of permanent staining or discoloration of grout surface.

Packaging

25 lb. plastic bags (11.34 kg)

10 lb. plastic bags (4.54 kg)

7 lb. plastic bags (3.18 kg)

Color

Visit tecspecialty.com for up-to-date color availability.

Substrate Preparation

Proper preparation of the tile and joint surfaces is important and will help promote a quality installation. The joints between the tiles should be free from foreign materials, and be at least 2/3 of the thickness of the tile in depth. High ridges of adhesive or mortar should be raked out. Any spacers used should be removed. Tiles should be held firmly in place according to manufacturer's instructions before grouting.

Power Grout is a highly pigmented product and it is critical to protect surrounding areas from exposure to pigment. Be sure to protect cabinets, countertops, and other surrounding areas which might become stained by the pigment present in the grout. This is especially important with dark colors which include black pigment.

Due to rough surface texture or high porosity, some tiles require sealing prior to grouting. Consult the tile manufacturer's/fabricator's literature for advice regarding this point. For removing any remaining grout residue, use a grout haze remover.

Notes: Power Grout never needs sealing, however, if the tile or stone is to be sealed after grout is installed, use a compatible solvent based sealer. Test a small area of the tile/stone and grout to ensure you achieve the desired results. If a water-based sealer is required, consult Technical Support for a list of approved sealers or pre-seal the tile/stone. When pre-sealing, do not apply sealer to tile/stone edges as this may prevent proper grout bond.

May scratch polished marble, polished porcelain, glass and/or metal tile or glazed tiles. Follow tile manufacturer/ fabricator recommendations or test a small area prior to use to determine suitability.

For industrial and commercial installations where chemical resistance is required, use TEC® AccuColor EFX® Epoxy Grout and Mortar in accordance with ANSI A118.3 recommendations.

Coverage

Figures shown in the chart are presented only as guidelines.

Approximate Coverage per Pound

Tile Size	Joint Width				
	1/16"	1/8"	1/4"	3/8"	1/2"
1" x 1" x 1/4"	3.64 ft²	1.82 ft²			
2" x 2" x 1/4"	7.29 ft²	3.64 ft²			
3" x 6" x 1/4"	14.58 ft²	7.29 ft²	3.64 ft²	2.43 ft²	1.82 ft²
4 1/4" x 4 1/4" x 1/4"	15.48 ft²	7.74 ft²	3.87 ft²	2.58 ft²	1.94 ft²
6" x 6" x 1/4"	21.88 ft²	10.93 ft²	5.46 ft²	3.64 ft²	2.73 ft²
6" x 24" x 3/8"	23.31 ft²	11.66 ft²	5.83 ft²	3.89 ft²	2.91 ft²
6" x 36" x 3/8"	25.00 ft²	12.48 ft²	6.25 ft²	4.16 ft²	3.12 ft²
8" x 8" x 3/8"	19.42 ft²	9.72 ft²	4.86 ft²	3.24 ft²	2.43 ft²
10" x 10" x 3/8"	24.27 ft²	12.15 ft²	6.07 ft²	4.05 ft²	3.04 ft²
12" x 12" x 3/8"	29.15 ft²	14.58 ft²	7.29 ft²	4.86 ft²	3.64 ft²
12" x 24" x 3/8"	38.91 ft²	19.42 ft²	9.72 ft²	6.48 ft²	4.86 ft²
18" x 18" x 3/8"	43.67 ft²	21.88 ft²	10.93 ft²	7.29 ft²	5.46 ft²
20" x 20" x 3/8"	48.54 ft²	24.27 ft²	12.15 ft²	8.10 ft²	6.07 ft²
24" x 24" x 3/8"	58.14 ft²	29.15 ft²	14.58 ft²	9.72 ft²	7.29 ft²

Approximate Coverage per Kilogram

Tile Size	Joint Width				
	1.6 mm	3 mm	6 mm	9 mm	12 mm
25 x 25 x 6 mm	0.75 m²	0.37 m²			
50 x 50 x 6 mm	1.49 m²	0.75 m²			
75 x 150 x 6 mm	2.99 m²	1.49 m²	0.75 m²	0.50 m²	0.37 m²
108 x 108 x 6 mm	3.17 m²	1.59 m²	0.79 m²	0.53 m²	0.40 m²
150 x 150 x 6 mm	4.48 m²	2.24 m²	1.12 m²	0.75 m²	0.56 m²
150 x 600 x 9 mm	4.77 m²	2.39 m²	1.19 m²	0.80 m²	0.60 m²
150 x 900 x 9 mm	5.12 m²	2.56 m²	1.28 m²	0.85 m²	0.64 m²
200 x 200 x 9 mm	3.98 m²	1.99 m²	0.99 m²	0.66 m²	0.50 m²
250 x 250 x 9 mm	4.97 m²	2.49 m²	1.24 m²	0.83 m²	0.62 m²
300 x 300 x 9 mm	5.97 m²	2.99 m²	1.49 m²	0.99 m²	0.75 m²
300 x 600 x 9 mm	7.97 m²	3.98 m²	1.99 m²	1.33 m²	0.99 m²
450 x 450 x 9 mm	8.94 m²	4.48 m²	2.24 m²	1.49 m²	1.12 m²
500 x 500 x 9 mm	9.94 m²	4.97 m²	2.49 m²	1.66 m²	1.24 m²
600 x 600 x 9 mm	11.91 m²	5.97 m²	2.99 m²	1.99 m²	1.49 m²

Storage

Store in cool, dry location. Do not store open containers.

Shelf Life

Maximum of 18 months from date of manufacture in unopened package.

The information in this product data sheet is valid for 90 days from the date listed above. Please visit www.tecspecialty.com/product-support to view or download the most current information.

Limitations

- Jobsite and grout temperature should be 50º-80ºF (10º-27ºC) for optimal installation.
- Do not install during temperatures below 50°F (10°C).
- Steam cleaning not recommended

Cautions

Read complete cautionary information printed on product container prior to use. For medical emergency information, call 1-888-853-1758.

This Product Data Sheet has been prepared in good faith on the basis of information available at the time of publication. It is intended to provide users with information about and guidelines for the proper use and application of the covered TEC brand product(s) under normal environmental and working conditions. Because each project is different, H.B. Fuller Construction Products Inc. cannot be responsible for the consequences of variations in such conditions, or for unforeseen conditions.

4. TECHNICAL DATA

Applicable Standard

When mixed with water and tested, Power Grout exceeds ANSI A118.7 Specifications for Ceramic Tile Grouts, Polymer-modified Cement Grout and meets the listed ANSI A118.3 Specifications for Epoxy Grouts.

ISO 13007: Classification CG2WAF

Power Grout (550)		
Description	**ANSI A118.7 Requirement**	**Typical Results**
28 Day Compressive Strength	≥ 3000 psi (20.7 MPa)	10,300 psi (71 MPa)
28 Day Tensile Strength	≥ 500 psi (3.4 MPa)	700 psi (4.8 MPa)
28 Day Flexural Strength	≥ 1000 psi (6.9 MPa)	1350 psi (9.3 MPa)
27 Day Linear Shrinkage	< 0.20% shrinkage	0.082% shrinkage
28 Day Water Absorption	< 5% absorption	1.1% absorption
Description	**ANSI A118.3 Requirement**	**Typical Results**
7 Day Linear Shrinkage	<.25% shrinkage	0.10-0.11% shrinkage
7 Day Compressive Strength	≥ 3500 psi (24.2 MPa)	7000-8000 psi (48.3-55.2 MPa)
Sag in Vertical Joints	Pass	Pass

Greater than: > Greater than or equal to: ≥ Less than: < Less than or equal to: ≤

Physical Properties

Description	
Physical State	Dry powder
Color	Available in multiple colors
Pot Life	35-55 minutes
Stain Resistance	Allow to cure for 7 days to achieve maximum stain resistance.
Initial Cure [at 72°F (22°C)]	3 to 4 hours
Final Cure	21 days
Foot Traffic Rating (ASTM C627)	Residential to Extra Heavy Commercial
Storage	Store in cool, dry location. Do not store open bags. Use full bags for installation.
Shelf Life	Maximum 18 months from date of manufacture in unopened package

5. INSTALLATION INSTRUCTIONS

Mixing

For best results pour water in a bucket and then add powder. In a clean mixing container, add Power Grout to clean, cold water as specified below:

Size	Water
25 lbs. (11.34 kg)	2.25-2.75 quarts [72-88 fl. oz.] (2.13-2.60 L)
10 lbs. (4.54 kg)	3.6-4.4 cups [28.8-35.2 fl.oz] (0.85-1.04 L)
7 lbs. (3.18 kg)	2.6-3.1 cups [20.2-24.6 fl. oz.] (596-729 mL)

1. Start with the low-end water range. Add water per instructions. Do not over water.
2. Mix with a drill (350 rpm max.) and mixing paddle attachment for a minimum of 2 minutes. Drill mixing is preferred and provides optimal results – hand mixing will yield acceptable results.
   - Do not add more water until mixture has been mixed for 2 minutes. Product consistency will loosen with mixing. Add water with care not to exceed recommended range. Under conditions that can result a shorter pot life, (i.e. hot weather), mix at the top end of the water range to provide more working time.
3. Allow to slake in bucket for 3-5 minutes
4. Remix with drill and mixing paddle for a minimum of 1 minute

Note: HBF-CP recommends that a full container of Power Grout be mixed and used at one time. However, if less than a full container of grout or multiple containers from different lot numbers are used, pre-mix the entire contents of the container(s) prior to mixing with water. (The fine pigment particles may settle during shipment and color variance can occur in the finished joint unless you first dry blend in this fashion.)

To ensure color consistency across the installation, use the same water to grout proportions when using multiple containers for the same job.

Application

Fully pack the joints between the tiles by spreading Power Grout with a clean, hard rubber float. Work only a small area at one time [5-10 sq. ft. (0.5-1 m^2)]. Apply in a diagonal direction across the joint lines to prevent the grout from being dragged out of the joints. Go over each area several times from all directions to make sure that the grout is fully packed in. Remove any excess grout from the surface of the tile by holding the float at a 90° angle to the surface and moving it diagonally across the joints. Repeat the entire process until all joints are grouted.

When grouting very absorptive tiles e.g. bisque tile and/or for thin grout lines, mix Power Grout to the highest water ratio. Additionally, pre-moistening the tile edges by spraying or wiping with a damp sponge or towel will help ensure that the grout retains water needed to properly cure.

Clean-up

Allow grout to firm up 15-30 minutes under normal conditions before final cleanup. Check for firmness by touching the grout with your finger. If there is transfer, wait 5 minutes and test again.

Wet a grout sponge in a pail containing cool, fresh water and wring out. Loosen the grout on the tile surface by moving the sponge in a circular motion across the tiles. Then use the sponge to smooth the joints. Completely rinse and wring out the sponge. Wipe diagonally across the tiles to remove grout residue. Use each side of the sponge once, then rinse, completely wring out and repeat. Change the water frequently.

Allow the grout to dry 30 to 60 minutes and remove all remaining grout residue from the tiles with a damp sponge or terrycloth towel.

Protection

Protect the finished installation from foot traffic or impact for at least 4 hours. Wait 24 hours before mopping, routine cleaning or shower use. Do not expose to stains, complete water immersion or freezing for 7 days.

No need to seal grout. If tile or stone is to be sealed after grout is installed, use a compatible solvent based sealer. Test a small area of the tile/stone and grout to ensure you achieve the desired results.

If a water-based sealer is required, consult Technical Support for a list of approved sealers. Allow grout to cure for 72 hours before sealing.

6. AVAILABILITY

TEC Premium Tile and Stone Installation Products are available nationwide. To locate TEC products in your area, please contact:

Phone: 800-832-9002
Website: tecspecialty.com

7. LIMITED WARRANTY

The product(s) covered by this Product Data Sheet are sold subject to a Limited Warranty and related terms. **H.B. Fuller Construction Products disclaims the implied warranties of merchantability and fitness for a particular purpose and all incidental and consequential damages arising out of the sale, purchase or use of this product.** For Limited Warranty details visit tecspecialty.com. To obtain a hard copy

of the Limited Warranty call H.B. Fuller Construction Products at 800-832-9023 or mail a written request to the address in Section 2 of this Product Data Sheet.

8. MAINTENANCE

Not applicable

9. TECHNICAL SERVICES

Technical and safety literature

To acquire technical and safety literature, please visit our website at tecspecialty.com.

10. FILING SYSTEM

Division 9

Conforms with LEED v4 low emitting interiors.
Compliant with (CDPH) Standard Method v1.2 VOC Emissions.



To learn more, visit TECspecialty.com

H.B. Fuller

H.B. Fuller Construction Products Inc. | 1105 South Frontenac Street Aurora, IL 60504-6451

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700 Series (TPR) Rubber Wall Base

TECHNICAL DATA

PRODUCT DESCRIPTION

Finish & Appearance	Traditional Cove & No Toe Base Available in all Sizes
Nominal Dimensions [1]	2 1/2" (6.35 cm) x 48" (1.22 m) or 120' (36.58 m) x 0.125" (3.2 mm) 4" (10.2 cm) x 48" (1.22 m) or 120' (36.58 m) x 0.125" (3.2 mm) 4 1/2" (11.4 cm) x 48" (1.22 m) or 120' (36.58 m) x 0.125" (3.2 mm) 6" (15.2 cm) x 48" (1.22 m) or 120' (36.58 m) x 0.125" (3.2 mm)
Available Corner Options	***All available corners have 2 1/4" returns*** Cove Outside Corners are available in all sizes Cove Inside Corners are available in all sizes No Toe Outside Corners are available in 2 1/2", 4", & 4 1/2" sizes
Non-Available Corner Options	No Toe Outside Corners are not available in 6" sizes No Toe Inside Corners are not available in any sizes

PRODUCT PERFORMANCE PROPERTIES

ASTM F1861 – Resilient Wall Base	Type TP, Group 2, Styles A & B
ASTM E648 (NFPA 253) – Critical Radiant Flux	Class I, ≥ 0.45 W/cm^2
ASTM E662 (NFPA 258) – Smoke Density	Passes, ≤ 450
ASTM E84 – Flammability	Class A
CAN/ULC-S102.2 – Surface Burning	10 Flame Spread Rating 60 Smoke Development Classification
ASTM F925 – Chemical Resistance [2]	Excellent, Additional Chemical List available via chart
ASTM F137 – Flexibility	Excellent, No Crack or Break 1/4" Mandrel
ASTM F1515 – Light Stability	ΔE ≤ 8

PRODUCT INSTALLATION & WARRANTY INFORMATION

Lot Controlled	No
Suitable for In Floor Radiant Heat	Yes
Heat Weldable / Required	No
Indoor / Outdoor Suitability	Indoor Use Only
Service & Storage Temperature Range [3]	60° - 85° F
Recommended Adhesives [4]	Excelsior WB-600 Wall Base Adhesive Excelsior C-631 Contact Adhesive
Product Warranty [5]	5 Year Limited Commercial Warranty

ATTRIBUTES, CERTIFICATIONS, & REGULATORY INFORMATION

- Manufactured in Miami, Florida
- Health Product Declaration (HOD) Available
- Contributes to LEED v4/4.1 Requirements
- Achieved NSF/ANSI 332 Level 1 Certification
- Achieved FloorScore Certification
- Achieved USDA Biopreferred Certification for 51% Biobased Content
- Meets California Department of Public Health V1.2 (CA Section 01350) requirements
- Meets Collaborative for High Performance Schools (CHPS) requirements
- Qualifies for American Made Products Acts and/or Requirements

SUPPORT & ADDITIONAL DOCUMENTATION

Product Support Phone & Email	(800) 537 – 9527 / sales@roppe.com
Technical Support Phone & Email	(844) 393 – 4044 / solutions@rhctechnical.com
Product Technical Documentation	www.roppe.com
Associated or Related Documentation	Excelsior WB-600 Wall Base Adhesive Excelsior C-631 Contact Adhesive 700 Series Wall Base Installation Wall Base Care & Maintenance Roppe Products Warranty Referenced Standards within Technical Documents Technical Bulletin

[1] Nominal Dimensions are the marketed dimensions of the product, tolerances are allowed in the manufacturing process and our tolerance range is what is allowed by the ASTM documentation overseeing the product construction.

[2] ASTM F925 testing is utilized to ensure flooring materials will stand up to certain household standard chemistries. Additional chemical resistance testing performed using this test method is for informational and guidance purposes only. Proper maintenance will influence chemical resistance, but the best defense against a negative effect is to clean the drop/spill from the flooring surface immediately.

[3] See installation documents for full installation details regarding approved substrates, job site conditions and acclimation procedures.

[4] Recommended adhesives listed are recommended to be used to obtain the full listed system warranty that includes a bond performance warranty. Material installed with adhesives other than those listed here or an approved option in writing will only have a product manufacturing and wear warranty, no performance or bond warranty.

[5] See product warranty for full details regarding limitations and warranty coverage.

The contents contained within this Technical Data Sheet (TDS) may be utilized or copied into another projected related document, but this original document will remain in effect at the time of product installation, this TDS shall not be supplemented or replaced by the resulting project documentation. **Any alterations to the wording or requirements contained in or derived from this document shall void all related warranties.**

See installation information and documents for full installation details regarding substrates, job site conditions, & acclimation procedures. The intent of this document is to provide technical and performance properties of the mentioned adhesive as well as define the intended method of installation for the products in which the adhesive is approved for use. Any installation guidelines are to be considered as a starting point at a minimum for a successful installation. We rely on the expertise and professionals that are installing the products to adjust based on site conditions. Anything that appears to be a link, is and leads to additional information if necessary or provides a means of contact in the event there are any additional questions. Prior to acceptance of this document refer to the product website to confirm that you have the most current revision.

These products are intended for installation by professionals, prior to use the user must determine the suitability of our products for the intended use, and the user alone assumes all risks and liability.

Vinyl Stair Tread

TECHNICAL DATA

PRODUCT DESCRIPTION

Finish & Appearance	Ribbed
Nominal Dimensions [1]	42”, 48”, & 72”
Nose Configuration	Round Bull Nose, Square Nose, and/or Square Adjustable Nose
Available Abrasive Strip Colors	Safety Yellow, Black, Pebble White, Ocean Gray, Teak Brown, Beige, Galley Red, & Glow Strip
Available Ribbed/Smooth Rubber Insert Colors	Safety Yellow, Almond, Dark Gray, Brown, & Black

PRODUCT PERFORMANCE PROPERTIES

ASTM F2169 – Resilient Stair Treads	Type TP, Class 2, Group 1 and/or 2, Grade 1
ASTM E648 (NFPA 253) – Critical Radiant Flux	Class I, ≥ 0.45 W/cm^2
ASTM E662 (NFPA 258) – Smoke Density	Passes, ≤ 450
ASTM D2047 – Static Coefficient of Friction [2]	≥ 0.50
ASTM F925 – Chemical Resistance [3]	Excellent, Additional Chemical List available via chart
ASTM F1514 – Heat Stability	ΔE ≤ 8
ASTM F1515 – Light Stability	ΔE ≤ 8
ASTM D2240 – Hardness	≥ 85 Shore A

PRODUCT INSTALLATION & WARRANTY INFORMATION

Lot Controlled	No
Suitable for In Floor Radiant Heat	Yes
Heat Weldable / Required	Not Recommended
Indoor / Outdoor Suitability	Indoor Use Only
Service & Storage Temperature Range [4]	60° - 85° F
Recommended Adhesives [5]	Excelsior TP-620 Pressure Sensitive Tread Tape Excelsior PS-525 Modified Pressure Sensitive Adhesive Excelsior AW-510 Acrylic Wet-Set Adhesive Excelsior C-631 Contact Adhesive Excelsior U-705 Urethane Adhesive Excelsior EW-710 Urethane Enhanced Two-Part Epoxy Adhesive
Recommended Installation Accessories	Excelsior EN-610 Epoxy Nose Filler is required on all installations.
Product Warranty [6]	3 Year Limited Commercial Warranty for Light Duty Treads 5 Year Limited Commercial Warranty for Heavy Duty Treads
Product Limitations	Wider stairwells and stairwells that require pattern alignment will require additional planning and dry fitting prior to installation. We recommend ordering treads the next size up to achieve these layouts and installations. Our treads are manufactured to be trimmed on each end of the length and the depth of the tread.

ATTRIBUTES, CERTIFICATIONS, & REGULATORY INFORMATION

- Manufactured in Tuscumbia, Alabama
- Contributes to LEED v4/4.1 Requirements
- Achieved NSF/ANSI 332 Level 1 Certification
- Achieved FloorScore Certification
- Achieved USDA Biopreferred Certification for 41% Biobased Content
- Meets California Department of Public Health V1.2 (CA Section 01350) requirements
- Meets Collaborative for High Performance Schools (CHPS) requirements
- Qualifies for American Made Products Acts and/or Requirements

SUPPORT & ADDITIONAL DOCUMENTATION

Product Support Phone & Email	(800) 537 – 9527 / sales@roppe.com
Technical Support Phone & Email	(844) 393 – 4044 / solutions@rhctechnical.com
Product Technical Documentation	www.roppe.com
Associated or Related Documentation	Excelsior TP-620 Pressure Sensitive Tread Tape Adhesive Excelsior EN-610 Epoxy Nose Filler Excelsior AW-510 Acrylic Wet-Set Adhesive Excelsior PS-525 Modified Pressure Sensitive Adhesive Excelsior C-631 Contact Adhesive Excelsior U-705 Urethane Adhesive Excelsior EW-710 Urethane Enhanced Two-Part Epoxy Adhesive Referenced Standards within Technical Documents Technical Bulletin Vinyl Stair Tread Installation Vinyl Stair Tread Care & Maintenance Roppe Products Warranty

[1] Nominal Dimensions are the marketed dimensions of the product, tolerances are allowed in the manufacturing process and our tolerance range is what is allowed by the ASTM documentation overseeing the product construction.

[2] ADA Standards for Accessible Design states the floor surface shall be stable, firm and slip resistant. Our test results utilize the James Machine as described in ASTM D2047 and as described in UL410 for floor covering materials (FCM) utilizing a leather foot under dry conditions. Maintenance processes and commonly utilized site applied finishes, polishes, and other sealers to maintain resilient flooring products will change the walking surface and ultimately the Static Coefficient of Friction.

[3] ASTM F925 testing is utilized to ensure flooring materials will stand up to certain household standard chemistries. Additional chemical resistance testing performed using this test method is for informational and guidance purposes only. Proper maintenance will influence chemical resistance, but the best defense against a negative effect is to clean the drop/spill from the flooring surface immediately.

[4] See installation documents for full installation details regarding approved substrates, job site conditions and acclimation procedures.

[5] Recommended listed adhesives are recommended to be used to obtain the full listed system warranty that includes a bond performance warranty. Material installed with adhesives other than those listed here or an approved option in writing will only have a product manufacturing and wear warranty, no performance or bond warranty.

[6] See product warranty for full details regarding limitations and warranty coverage.

The contents contained within this Technical Data Sheet (TDS) may be utilized or copied into another projected related document, but this original document will remain in effect at the time of product installation, this TDS shall not be supplemented or replaced by the resulting project documentation. **Any alterations to the wording or requirements contained in or derived from this document shall void all related warranties.**

See installation information and documents for full installation details regarding substrates, job site conditions, & acclimation procedures. The intent of this document is to provide technical and performance properties of the mentioned adhesive as well as define the intended method of installation for the products in which the adhesive is approved for use. Any installation guidelines are to be considered as a starting point at a minimum for a successful installation. We rely on the expertise and professionals that are installing the products to adjust based on site conditions. Anything that appears to be a link, is and leads to additional information if necessary or provides a means of contact in the event there are any additional questions. Prior to acceptance of this document refer to the product website to confirm that you have the most current revision.

These products are intended for installation by professionals, prior to use the user must determine the suitability of our products for the intended use, and the user alone assumes all risks and liability.

#1 Home Improvement Retailer

Pleasant Ridge 10PM 45213 Wh Pleasant Ridge 10PM 45213 Shop All Services DIY Log In

Home / Bath / Toilets / Toilet Seats

Internet # 317418758 Model # K-R25781-A-0 Store SKU # 1006585726

KOHLER

Cachet Elongated Antimicrobial, Soft Close Front Toilet Seat in White

(2252) Questions & Answers (82)










Hover Image to Zoom

Share Print

Colony® Chair Height Elongated One-Piece Toilet With Seat

VITREOUS CHINA

Colony® Chair Height Elongated
One-Piece Toilet With Seat

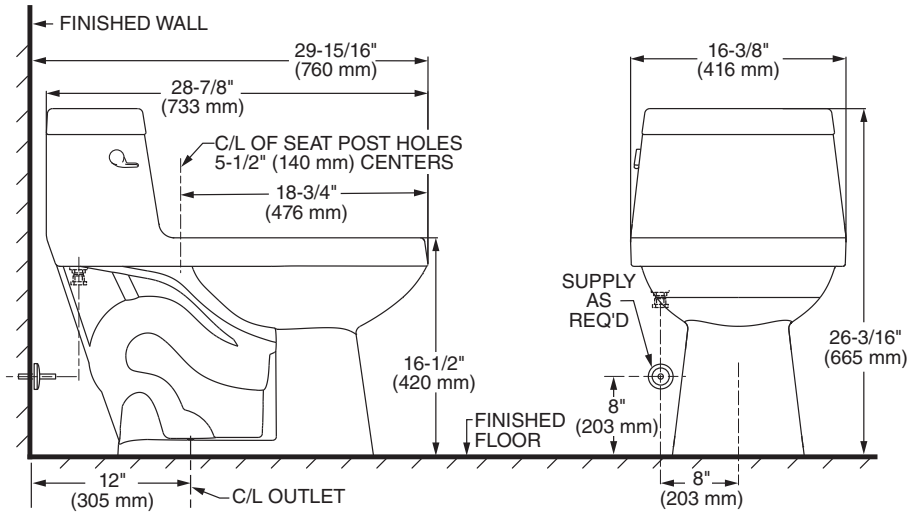


❑ **2961A104SC**

- One-piece construction eliminates crevices for easy cleaning
- Low profile fits where space is limited
- Vitreous china made High Efficiency Toilet (HET), ultra-low consumption (1.28 gpf/4.8 Lpf), utilizes 20% less water and meets EPA WaterSense® Criteria
- 3" flush valve with fully-glazed 2" trapway for optimal performance
- 12" rough-in toilet with 16-1/2" rim chair height for accessible applications
- Includes sturdy, slow-close seat that never slams
- Includes polished chrome, side-mounted trip lever
- Industry-leading lifetime warranty on chinaware, 2 year warranty on all mechanical parts and 1 year warranty on seat

Nominal Dimensions:
29-15/16" x 16-3/8" x 26-3/16"
(760 x 416 x 665 mm)

Fixture only, supply by others



Compliance Certifications -
Meets or Exceeds the Following Specifications:

- ASME A112.19.2M for Vitreous China Fixtures
- US EPA WaterSense® Specification for HETs

NOTES:
THIS TOILET IS DESIGNED TO ROUGH-IN AT A MINIMUM DIMENSION OF 12" (305mm) FROM FINISHED WALL TO C/L OF OUTLET.
SUPPLY NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY.
* DIMENSION SHOWN FOR LOCATION OF SUPPLY IS SUGGESTED.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerance established by ANSI Standard A112.19.2
These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

To Be Specified:
❑ Color:
❑ White
❑ Supply with Stop:

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ICC ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES-CHECK LOCAL CODES.

EPA WATERSENSE® CERTIFIED | WATER EFFICIENT

© 2021 AS America Inc.

PART OF LIXIL

60 in. x 30 in. Soaking Bathtub with Left Drain in White

$329.00

Top

STERLING (275) 1.5K

Product Details | Specifications | Questions & Answers | Customer Reviews

- Shop more Bathtubs at The Home Depot to find the best option for your home
- Click here to shop for more Kohler products
- Return Policy

Product Information

Internet # 302568786
Model # 71171710-0
Store SKU # 1002637722

Specifications

Dimensions

Basin Length (in.)	53	**Basin Width (in.)**	23
Overall Height (in.)	16	**Overall Length (in.)**	60
Overall Width (in.)	30	**Soaking Depth (in.)**	11.25

Details

Bath Therapy Type	Soaking	**Color Family**	White
Color/Finish	White	**Drain Location**	Left
Exterior bath shape	Rectangular	**Faucet mount**	Wall
Included	No additional components or accessories are included	**Material**	Acrylic
Maximum Number of Occupants	1 Person	**Product Weight (lb.)**	68 lb
Returnable	90-Day	**Style**	Minimalist, Modern
Tub/Shower Features	No additional features	**Water capacity (gallons)**	44

Warranty / Certifications

Certifications and Listings	No Certifications or Listings	**Manufacturer Warranty**	10-Year Residential/3-Year Commercial Limited Warranty

How can we improve our product information? Provide feedback.



Pro-Series 60 in. W x 57 in. H Five Piece Glue Up Bathtub Surrounds in High Gloss White

$109.00

Top

Delta ★★★★☆(540) ♡ 7.1k

draining soap dishes and the panels are easy to trim to accommodate a window. The walls have a high-gloss finish and the glue-up installation design enables hassle-free setup.

Highlights

- 5-piece bathtub wall set fits alcoves up to 60 in. wide x 32 in. deep
- 5-piece design for ease of transportation and installation
- 4 shelves with integrated soap dishes for convenient storage
- Back panel can be cut for a window opening
- Install to 1/2 in. (13 mm) drywall or water-resistant drywall, do not install panels over existing ceramic tile or plywood
- Install surface must be free of dirt, film, waxes, wallpaper, or any other residues, painted surfaces must be sanded
- Recommended adhesive: DAP 3.0, RD 3000, and ECO-BOND
- Click here to shop more Delta products
- Return Policy

Product Information

Internet # 204338479
Model # 40154
Store SKU # 285112

From the Manufacturer

- Specification
- Warranty
- Installation Guide
- Return Policy



GE Advanced Silicone 2 Caulk 10.1 oz Kitchen and...

★★★★½ (4.4 / 1886)

$10.98

Buy 24 or more $9.88

Shop Now

Sponsored

Specifications

Dimensions

Product Depth (in.)	32 in	**Wall Height (in.)**	57
Wall Width (in.)	60		

Details

Caulkless	No	**Color Family**	White
Color/Finish	High Gloss White	**Construction**	Five piece
Material	Composite	**Product Weight (lb.)**	16 lb
Returnable	90-Day	**Shower Type**	Tub
Style	Modern	**Surface Type**	Smooth
Wall Installation Type	Glue Up		

Warranty / Certifications

Certifications and Listings	No Certifications or Listings	**Manufacturer Warranty**	Limited 1-year warranty

Rely®

60" x 30" alcove shower base, right drain

K-8642

Features

- Low-threshold design for easy entry and exit
- Molded-in textured floor
- Water containment bead incorporated into threshold design provides an optimum barrier, preventing water from escaping from shower space
- Single threshold for alcove installation
- Coordinates with Choreograph® shower walls and other KOHLER® collections



Material

- Acrylic

Installation

- Right drain

Recommended Products/Accessories

K-23726 Drain treatment
K-9132 Shower Drain

Codes/Standards

CSA B45.5/IAPMO Z124
ASTM E162
ASTM E662

KOHLER® Plastic Baths and Shower Bases Lifetime Limited Warranty

See website for detailed warranty information.

Available Colors/Finishes

Color tiles intended for reference only.

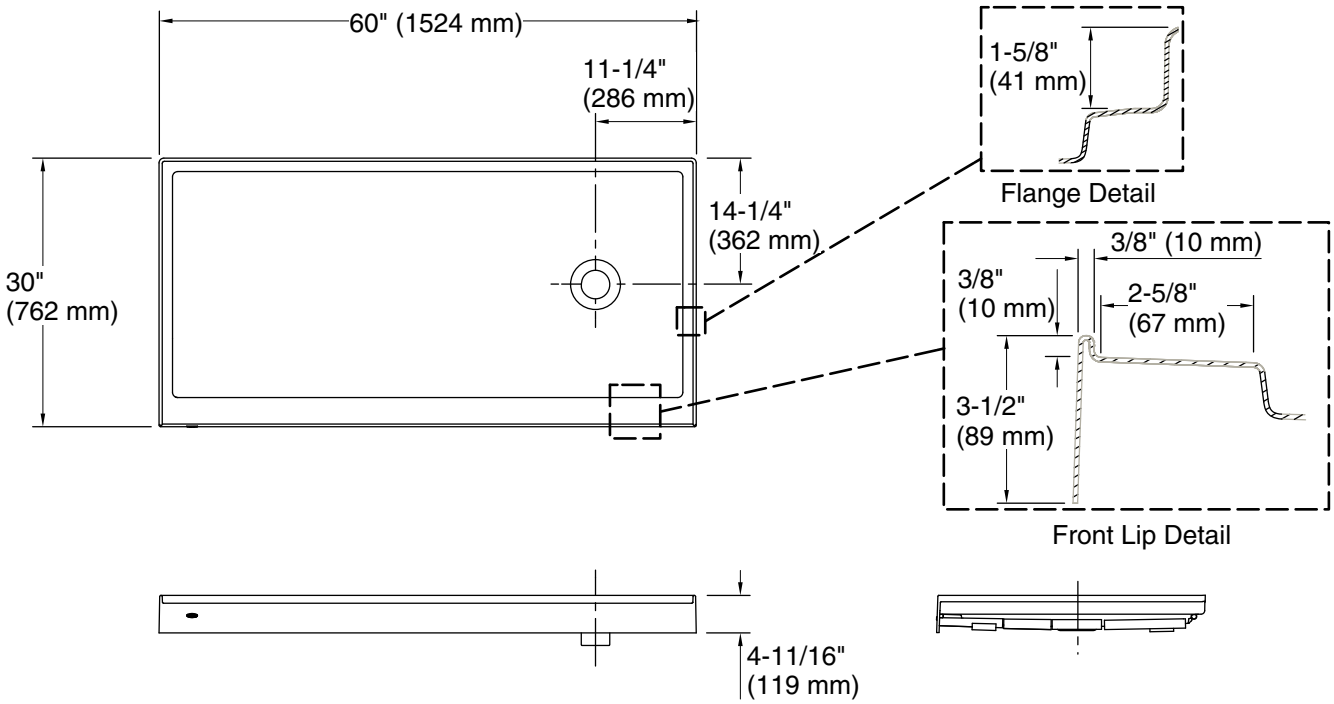
Color	Code	Description
	0	White
	96	Biscuit
	NY	Dune
	95	Ice™ Grey

KOHLER®

Rely®

60" x 30" alcove shower base, right drain

K-8642



Technical Information

All product dimensions are nominal.

Drain location:	Right
Weight:	59 lbs (26.8 kg)
Minimum flat for door:	2-5/8" (67 mm)

Notes

Measure your actual product for rough-in details.

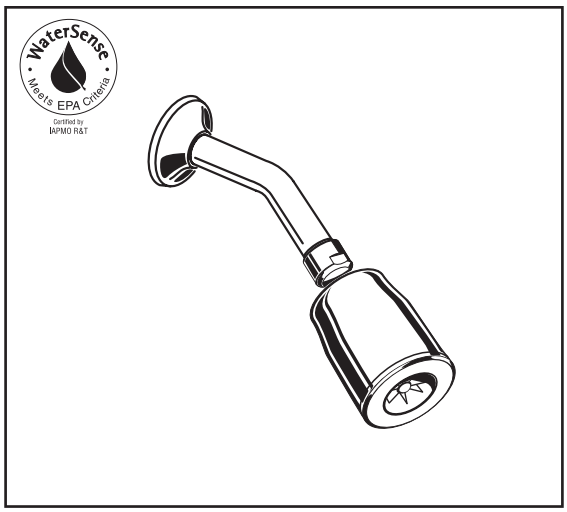
Install this product according to the installation instructions.

Subfloor must be within 1/2" (13 mm) of level.

This receptor has a front lip. This should be taken into account when installing a shower door.

American Standard
Style That Works Better

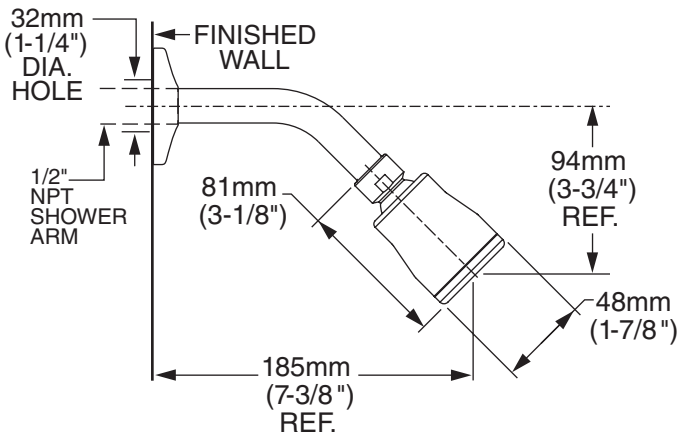
FLOWISE®
SINGLE FUNCTION WATER SAVING SHOWERHEAD



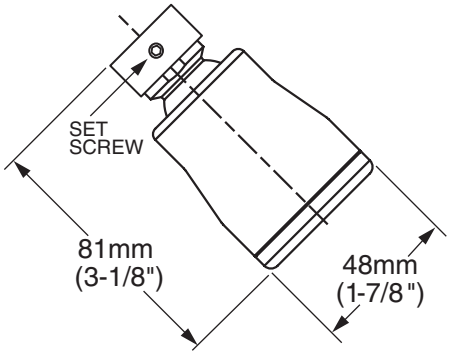
1660.731 Shown

MODEL NUMBER:

- ❑ **1660.731 FloWise® Water Saving Showerhead** with Shower Arm & Flange
- ❑ **1660.710 FloWise® Water Saving Showerhead Only**
- ❑ **1660.711 FloWise® Vandal Resistant Water Saving Showerhead Only**



VANDAL RESISTANT VERSION
1660.711



GENERAL DESCRIPTION:

Showerhead uses 40% less water than standard 2.5gpm showerheads. Showerhead rated at 1.5gpm/5.7L/min. maximum flow rate. Showerhead has single spray function using Turbine Technology. Pressure compensating flow control device. Vandal Resistant model includes tamper-proof metal sleeve with set screw to lock showerhead in place.

PRODUCT FEATURES:

Water Saving: Saves up to 40% in water usage.

Pressure Compensating Flow Control Device: Provides consistent flow over a wide pressure range.

Single Function: Showerhead provides drenching spray for full coverage of the user.

SUGGESTED SPECIFICATION

Showerhead shall save 40% in water usage. Showerhead shall always start at 1.5gpm/5.7L/min. Showerhead shall have a pressure compensating control device. Fitting shall be American Standard Model # 1660.7___.

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Revised 2/12

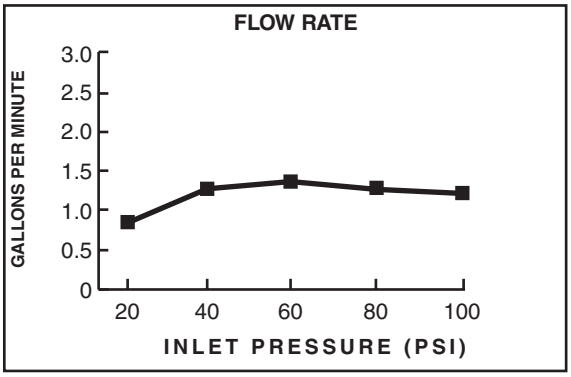
FLOWISE®
SINGLE FUNCTION WATER SAVING SHOWERHEAD

CODES AND STANDARDS

These products meet or exceed the following codes and standards:

ASME A112.18.1
CSA 125.1

GREEN
UPC
C ®



Product Number	Description	Finish: Polished Chrome 002
1660.731	FloWise® Water Saving Showerhead. With Shower Arm & Flange.	☐
1660.710	FloWise® Water Saving Showerhead Only.	☐
1660.711	FloWise® Vandal Resistant Water Saving Showerhead Only.	☐

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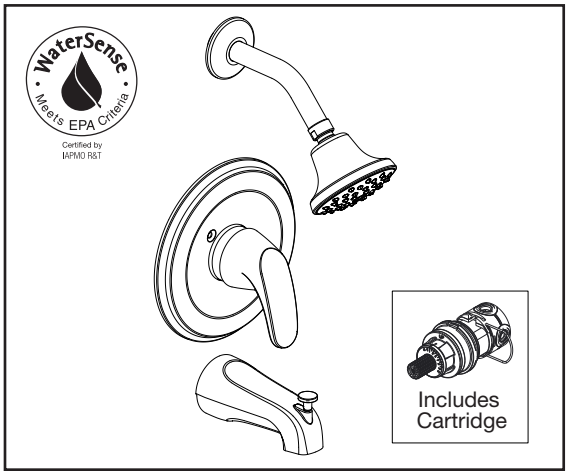
NO SHOWER HEAD

American Standard

Colony® Pro

Water-Saving Pressure Balance Bath/Shower Trim

with Double Ceramic Pressure Balance Cartridge



TU075508 Bath/Shower Trim Shown

GENERAL DESCRIPTION:

Double Ceramic Pressure Balance Cartridge: Features one-piece design with ceramic discs and ceramic balancing spool. Includes integrated check valves and hot limit safety stop. Cartridge capable of back to back capability. Ceramic balancing spool maintains constant output temperature in response to changes in relative hot and cold supply pressure. Washerless ceramic discs provide smooth handle movement and are unaffected by harsh water conditions.

Trim: Features water-saving showerhead with a maximum 1.75 gpm/6.6 L/min. flow rate. Metal slip-on diverter spout. Metal wall valve trim with metal lever with RED/BLUE indicator ring.

PRODUCT FEATURES

One-Piece Cartridge: Simplifies installation and maintenance.

Double Ceramic Pressure Balance Cartridge: Combination of Ceramic Disc Mixing Valve and a Ceramic Balancing Spool in a one-piece cartridge.

Ceramic Disc Mixing Valve: Assures a lifetime of drip-free performance and smooth handle operation.

Ceramic Balancing Spool: Maintains a constant output temperature in response to changes in relative hot and cold supply pressure. Ceramic material is unaffected by mineral deposits and harsh water conditions.

Integrated Check Valves: Engineered to eliminate cross flow.

Adjustable Hot Limit Safety Stop: Limits the amount of hot water allowed to mix with cold. Reduces the risk of accidental scalding.

Comfort Zone: Offers a wider shower range to fine tune the desired temperature within the useful temperature zone

Back-to-Back Capability: Hot and cold can be reversed quickly and easily.

Water Saving: Saves 30% water usage.

MODEL NUMBER:

TRIM KITS:

❑ **TU075508 Colony Pro Bath/Shower Trim Kit with Pressure Balance Cartridge**
Lever handle. Water-saving showerhead. LESS valve body.

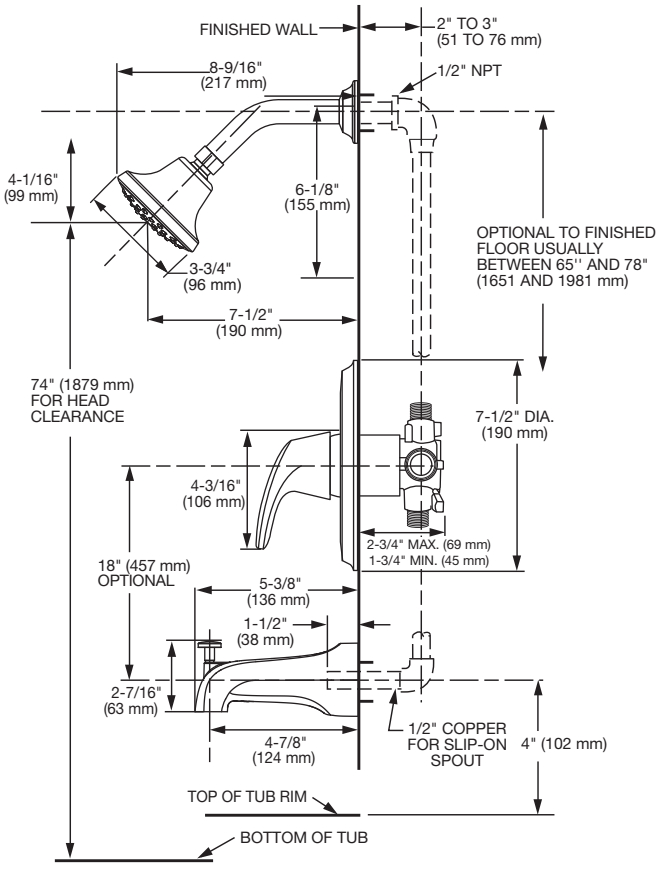
❑ **TU075507 Colony Pro Shower ONLY Trim Kit with Pressure Balance Cartridge**
Lever handle. Water-saving showerhead. LESS valve body.

❑ **TU075500 Colony Pro Bath/Shower Trim Kit with Pressure Balance Cartridge**
Lever handle. LESS valve body.

❑ **TU075508XH Colony Pro Bath/Shower Trim Kit with Pressure Balance Cartridge**
LESS showerhead. Lever handle. LESS valve body.

❑ **TU075507XH Colony Pro Shower ONLY Trim Kit with Pressure Balance Cartridge**
LESS showerhead. Lever handle. LESS valve body.

For use with Flash™ Rough Valve Bodies



SUGGESTED SPECIFICATION

Bath/shower fitting shall feature water saving showerhead with Max. 1.75 gpm/6.6 L/min. flow rate. Shall feature double ceramic pressure balance cartridge. Cartridge is capable of back to back installation and shall feature integrated check valves to eliminate cross flow. Capable of meeting ASSE1016 @1.3gpm. Cartridge shall also feature hot limit safety stop. Fitting shall be: American Standard - Trim Kit Model # TU07550_.___ and Flash Valve Body Model # RU10___.

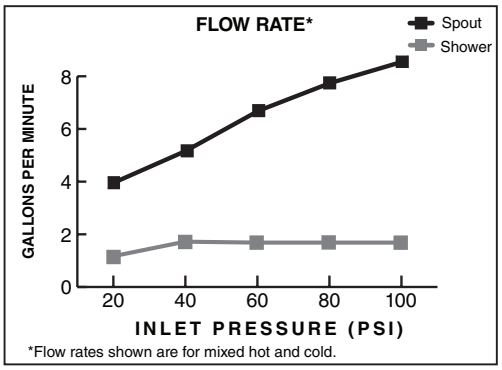
© 2023 AS America, Inc.

Colony® Pro
Water-Saving Pressure Balance Bath/Shower Trim
with Double Ceramic Pressure Balance Cartridge

CODES AND STANDARDS

These Products meet or exceed the following codes and standards:

ASSE 1016 / ASME A112.18.1016 / CSA B125.16
ASME A112.18.1 / CSA B125.1
Rated to meet ASSE 1016 @ 1.3gpm



TRIM KITS *	Product Number	Description	Finish Options			
			Polished Chrome	Legacy Bronze	Brushed Nickel	Matte Black
			002	278	295	243
	TU075508	Bath/Shower Trim Kit. Metal lever handle. Water-saving showerhead. Includes cartridge. LESS valve body.	✓	✓	✓	✓
	TU075507	Shower Only Trim Kit. Metal lever handle. Water-saving showerhead. Includes cartridge. LESS valve body. ADA	✓	✓	✓	✓
	TU075500	Valve Only Trim Kit. Metal lever handle. Includes cartridge. LESS valve body. ADA	✓	✓	✓	✓
	TU075508XH	Bath/Shower Trim Kit. Metal lever handle. LESS showerhead. Includes cartridge. LESS valve body.	✓	✓		
	TU075507XH	Shower Only Trim Kit. Metal lever handle. LESS showerhead. Includes cartridge. LESS valve body. ADA	✓			

*** TRIM & ROUGH MUST BE ORDERED SEPARATELY.**

Flash™ ROUGH VALVE BODIES	Product Description	Without Screwdriver Stops	With Screwdriver Stops
	Rough Valve Body. Universal* inlets/outlets.	RU101	RU101SS
	Rough Valve Body. Stub-out inlets/outlets for Press-Fit Fittings.	RU102	RU102SS
	Rough Valve Body. PEX inlets/Universal outlets for Crimp Ring PEX system (ASTM F1807).	RU107	RU107SS
	Rough Valve Body. PEX Elbow inlets/Universal outlets for Crimp Ring PEX system (ASTM F1807).	RU107E	RU107ESS
	Rough Valve Body. PEX inlets/Universal outlets for Cold Expansion PEX system (ASTM F1960).	RU108	RU108SS
	Rough Valve Body. PEX Elbow inlets/Universal outlets for Cold Expansion PEX system (ASTM F1960).	RU108E	RU108ESS
	Rough Valve Body. CPVC inlets/Universal outlets.	RU109	RU109SS

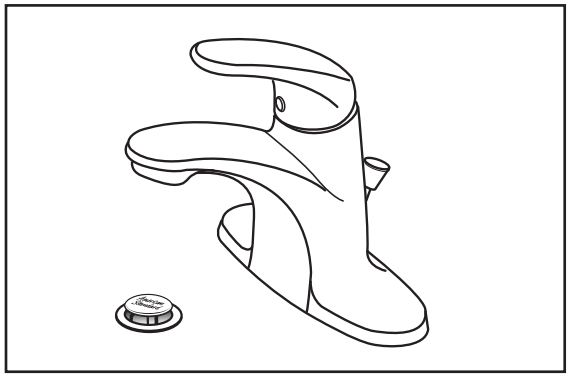
OPTIONAL ACCESSORY	Product Number	Product Description
	M970649-YYY0A	Deep Rough-In Kit

ADA Meets the American Disabilities Act Guidelines and **ANSI A117.1** Requirements for the physically challenged.

PART OF LIXIL

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COLONY® PRO
SINGLE CONTROL LAVATORY FAUCET



7075000 Shown

MODEL NUMBER:

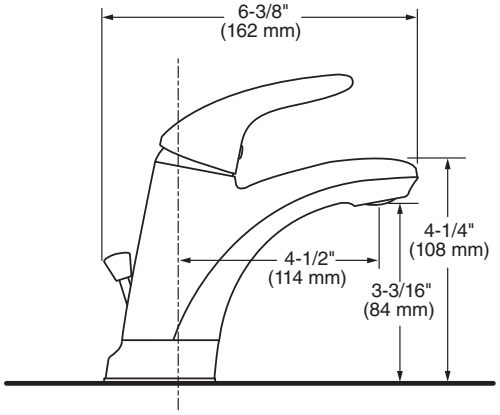
❑ **7075000 Single Control Centerset**
Metal lever handle. Metal pop-up drain.

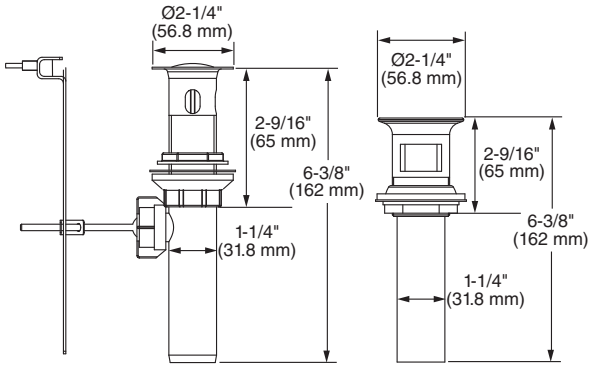
❑ **7075002 Single Control Centerset**
Metal lever handle. 50/50 pop-up drain.

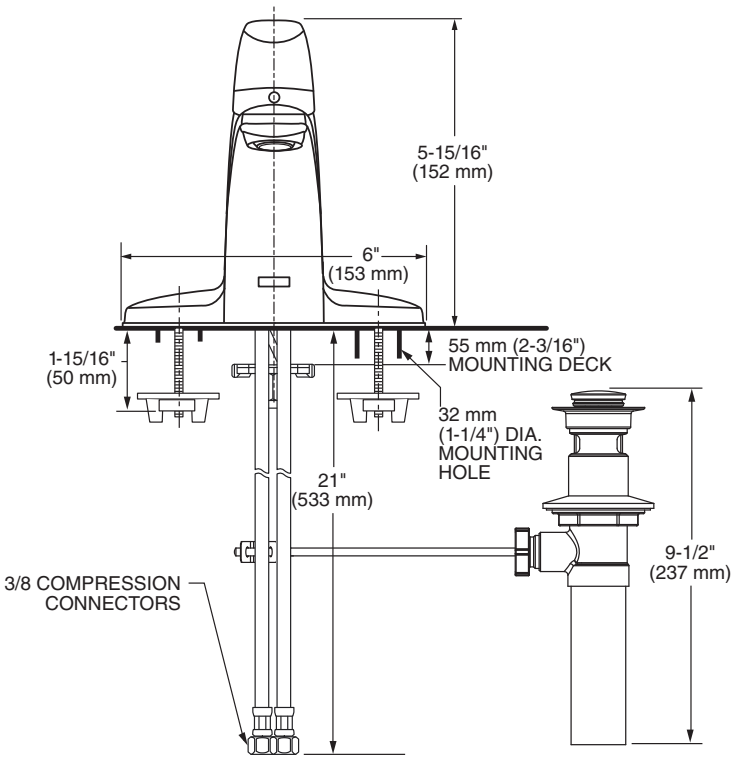
❑ **7075004 Single Control Centerset**
Metal lever handle. Less drain, less pop-up hole & rod.

❑ **7075005 Single Control Centerset**
Metal lever handle. Less drain. With pop-up hole & rod.

❑ **7075006 Single Control Centerset**
Metal lever handle. Grid drain. Less pop-up rod and hole.







GENERAL DESCRIPTION:

Metal body with metal lever handle. Washerless 35 mm ceramic disc valve cartridge with integral hot limit safety stop. 24" Color-coded braided flexible supply hoses with 3/8" compression connections. 1.2 gpm/4.5 L/min. maximum flow rate.

PRODUCT FEATURES:

Ceramic Disc Valve Cartridge: Assures smooth, precise valve control and a lifetime of drip-free, maintenance-free performance.

Adjustable Hot Limit Safety Stop: Limits the amount of hot water allowed to mix with cold. Reduces the risk of accidental scalding.

Lead Free: Faucet contains ≤ 0.25% total lead content byweighted average.

EPA WATERSENSE® CERTIFIED

SUGGESTED SPECIFICATION

Single control lavatory fitting shall feature a metal body with metal lever handle. Shall feature flexible hose connections. Shall also feature a washerless ceramic disc valve cartridge with integral hot limit safety stop. Fitting shall be American Standard Model # 707500X.___.

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American Standard

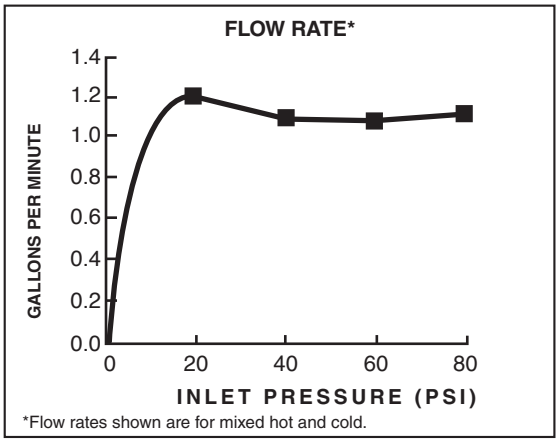
COLONY® PRO
SINGLE CONTROL LAVATORY FAUCET

CODES AND STANDARDS

These products meet or exceed the following codes and standards:

ANSI A117.1
ASME A112.18.1
CSA B125.1
NSF/ANSI/CAN 61: Q≤1
NSF/ANSI/CAN 372

CEC



*Flow rates shown are for mixed hot and cold.

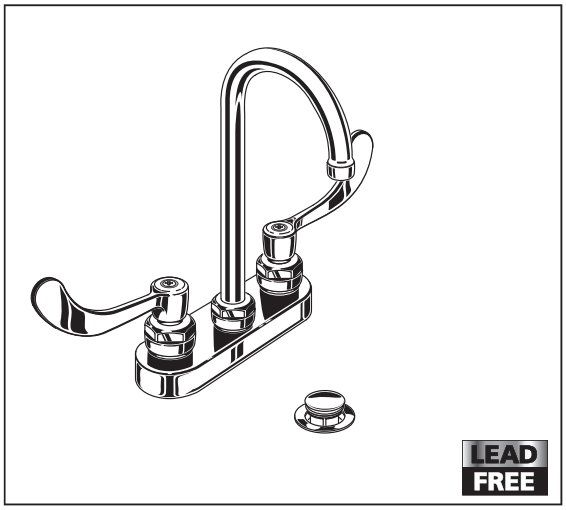
Product Number	Description	Finish Options			
		Polished Chrome	Legacy Bronze	Brushed Nickel	Matte Black
		002	278	295	243
7075000	Colony PRO Single Control Centerset. Metal lever handle. Metal pop-up drain. ADA	✓	✓	✓	✓
7075002	Colony PRO Single Control Centerset. Metal lever handle. 50/50 pop-up drain. ADA	✓	✓	✓	✓
7075004	Colony PRO Single Control Centerset. Metal lever handle. LESS drain, less pop-up hole & rod. ADA	✓		✓	✓
7075005	Colony PRO Single Control Centerset. Less drain. Metal lever handle. With pop-up hole & rod. ADA	✓	✓	✓	✓
7075006	Colony PRO Single Control Centerset. Metal lever handle. Grid drain. Less pop-up rod and hole. ADA	✓			

ADA Meets the American Disabilities Act Guidelines and **ANSI A117.1** Requirements for the physically challenged.

PART OF LIXIL

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MONTERREY™
TWO-HANDLE CENTERSET LAVATORY FAUCET
WITH GOOSENECK SPOUT



7500.170 Shown

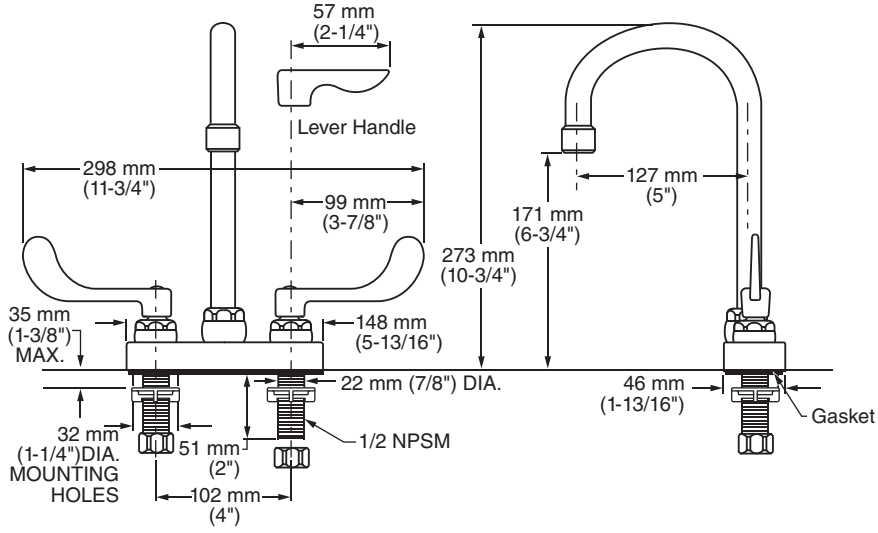
MODEL NUMBER:*

❑ **7500.170 Centerset Lavatory**
1.5 gpm Pressure Compensating Aerator. Rigid/swivel gooseneck spout. Vandal-Resistant Wrist Blade handles. Less drain and pop-up hole.

❑ **7502.170 Centerset Lavatory**
1.5 gpm Pressure Compensating Aerator. Rigid/swivel gooseneck spout. Vandal-Resistant Wrist Blade handles. Grid strainer drain.

❑ **7500.140 Centerset Lavatory**
1.5 gpm Pressure Compensating Aerator. Rigid/swivel gooseneck spout. Vandal-Resistant Lever handles. Less drain and pop-up hole.

❑ **7502.140 Centerset Lavatory**
1.5 gpm Pressure Compensating Aerator. Rigid/swivel gooseneck spout. Vandal-Resistant Lever handles. Grid strainer drain.



GENERAL DESCRIPTION:

Durable cast brass construction. 1/2" male threaded inlet shanks with shank nuts and brass coupling nuts. 1/4 turn ceramic disc valve cartridges. Field-convertible swivel/rigid spout. Choice of Vandal-Resistant Wrist Blade or Lever handles with blue & red color indexes. All brass drain body with 1 1/4" (32mm) tailpiece (on applicable models). 1.5 gpm/5.7L/min. maximum flow rate.

PRODUCT FEATURES:

Pressure Compensating Aerator: Provides a constant water flow of 1.5 gpm throughout the pressure range

Solid Brass Construction: Durable - Excellent in high use applications. Ideal for prolonged contact with water.

Ceramic Disc Valve Cartridge: Assures a lifetime of drip-free performance.

Field-Convertible Swivel/Rigid Spout: Easily adjusted in the field.

Lead-Free: Faucet contains ≤ 0.25% total lead content by weighted average.

SUGGESTED SPECIFICATION:

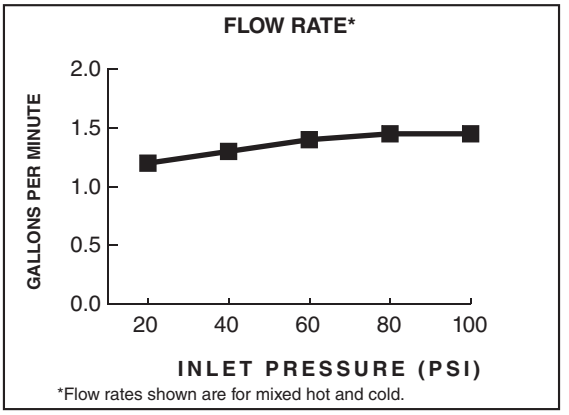
4" centerset lavatory faucet shall be cast brass construction with all brass shank nuts and coupling nuts. Shall feature water-conserving 1.5 gpm/5.7L/min. pressure compensating aerator. Vandal-Resistant handles. Shall also feature 1/4 turn washerless ceramic disc valve cartridges. Fitting shall be American Standard Model # 750_.___.002.

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CODES AND STANDARDS

These products meet or exceed the following codes and standards:

ASME A112.18.1
CSA B 125
NSF 372



Product Number	Description	Finish: Polished Chrome 002
7500.170	Centerset Lavatory with rigid/swivel gooseneck spout. 1.5 gpm/5.7L/min pressure compensating aerator. Vandal-Resistant Wrist Blade Handles. Less drain and pop-up hole.	
7502.170	Centerset Lavatory with rigid/swivel gooseneck spout. 1.5 gpm/5.7L/min pressure compensating aerator. Vandal-Resistant Wrist Blade Handles. Grid strainer drain.	
7500.140	Centerset Lavatory with rigid/swivel gooseneck spout. 1.5 gpm/5.7L/min pressure compensating aerator. Vandal-Resistant Lever Handles. Less drain and pop-up hole.	
7502.140	Centerset Lavatory with rigid/swivel gooseneck spout. 1.5 gpm/5.7L/min pressure compensating aerator. Vandal-Resistant Lever Handles. Grid strainer drain.	

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES-CHECK LOCAL CODES

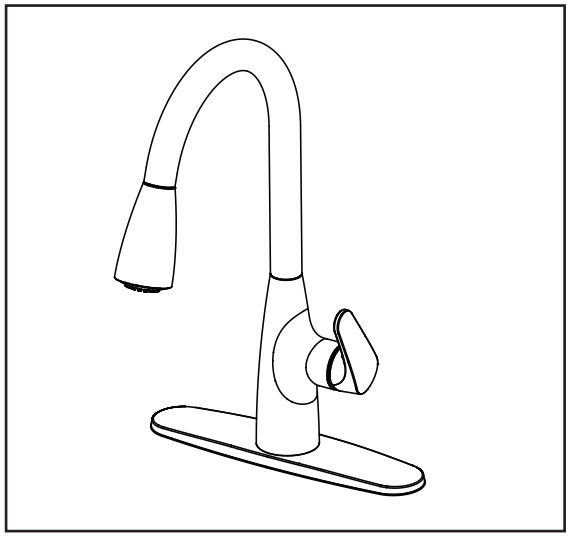
Other Aerators Available:

Part Suffix	Description
LV15	1.5 gpm (5.7 Lpm) PCA Vandal-Resistant Non-Aerated Laminar Flow Outlet
V15	.5 gpm (5.7 Lpm) PCA Vandal-Resistant Aerator
LV10	1.0 gpm (3.8 Lpm) PCA Vandal-Resistant Non-Aerated Laminar Flow Outlet
V10	1.0 gpm (3.8 Lpm) PCA Vandal-Resistant Aerator
V05	0.5 gpm (1.9 Lpm) PCA Vandal-Resistant Non-Aerated Spray
V035**	0.35 gpm (1.3 Lpm) PCA Vandal-Resistant Non-Aerated Spray

*PCA - Pressure Compensating
**Meets Cal Green Code

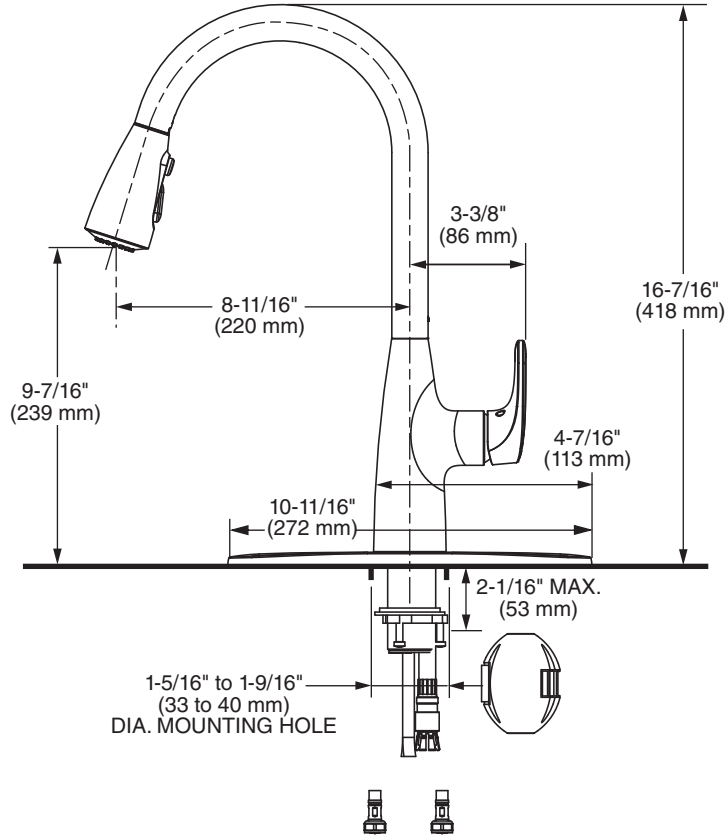
© 2014 AS America Inc.

Colony® Pro
Single Control Kitchen Faucet
With Pull-Down Spray



MODEL NUMBER:

❑ **7077300 Pull-Down Faucet**



GENERAL DESCRIPTION:

Metal body and handle with metal swivel spout. Pull-down spray with adjustable spray pattern and pause feature. Nylon braided pull out hose complete with two integral check valves. Washerless 28 mm ceramic disc valve cartridge. 35" Flexible, color coded braided stainless steel supply hoses with 3/8" compression connections. Mounting shank with brass fixation ring. 1.5 gpm/5.7 L/min. maximum flow rate. Fitting can be mounted with or without deck plate.

ADA COMPLIANT

PRODUCT FEATURES:

Ceramic Disc Valve Cartridge: Assures a lifetime of smooth handle operation and drip-free performance.

Metal Construction: Quality materials for durability & tlong life.

Memory Position Valving: Allows user to turn valve on and off at preferred temperature setting without readjusting handle position each time.

Lead Free: Faucet contains ≤ 0.25% total lead content by weighted average.

Pull-down Spray: Adjustable spray pattern-stream to spray and pause feature.

Integral Check Valves: Prevents back flow.

Choice of Finishes: Choice of Polished Chrome, Stainless Steel (PVD) or Matte Black.

SUGGESTED SPECIFICATION

Single control kitchen faucet shall feature a metal body with pull-down spray. Shall also feature washerless ceramic disc valve cartridge, flexible stainless steel supply hoses and two integral check valves. Fitting shall be American Standard Model # 7077300.___.

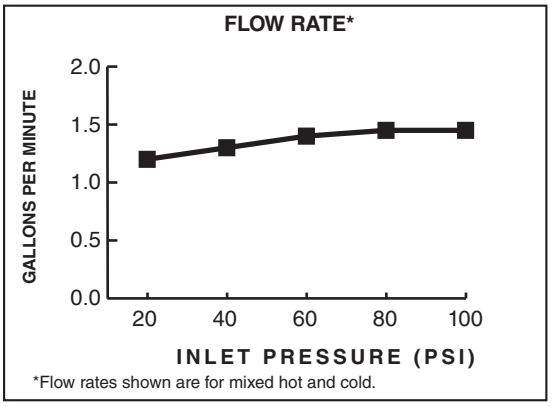
© 2022 AS America Inc.

Colony® Pro
Single Control Kitchen Faucet
With Pull-Down Spray

CODES AND STANDARDS

These products meet or exceed the following codes and standards:

ANSI A117.1
ASME A112.18.1
CSA B125.1
NSF/ANSI/CAN 61: Q<1
NSF/ANSI/CAN 372



1.5 gpm/5.7 L/min. FLOW RATE

Product Number	Description	Finish Options		
		Polished Chrome	PVD Stainless Steel	Matte Black
		002	075	243
7077300	Pull-Down Kitchen Faucet			

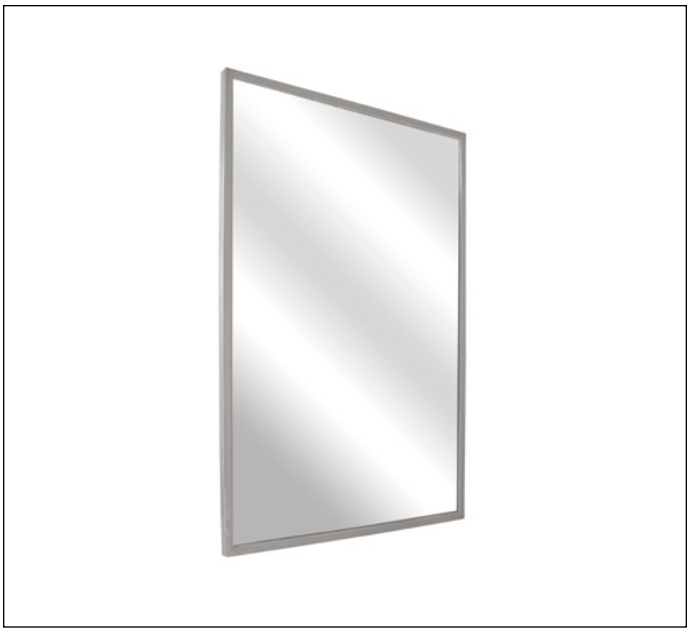
ADA Meets the American Disabilities Act Guidelines and **ANSI A117.1** Requirements for the physically challenged.

PART OF LIXIL

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781
Channel-Frame Mirror

- ○ **Standard Model 781-1824 (18" x 24") *BradEX®***
- ○ **Standard Model 781-1830 (18" x 30") *BradEX®***
- ○ **Standard Model 781-1836 (18" x 36") *BradEX®***
- ○ **Standard Model 781-18362 (18" x 36", tempered glass) *BradEX®***
- ○ **Standard Model 781-2430 (24" x 30") *BradEX®***
- ○ **Standard Model 781-2436 (24" x 36") *BradEX®***
- ○ **Standard Model 781-24362 (24" x 36", tempered glass) *BradEX®***
- ○ **Standard Model 781-2448 (24" x 48") *BradEX®***
- ○ **Standard Model 781-2460 (24" x 60") *BradEX®***
- ○ **Standard Model 781-XXX (Specify width and height)**



Product Materials

FRAME: One-piece, roll-formed stainless steel with bright annealed finish. Channel is 3/4" x 3/4" x 7/16" with 90° mitered corners. Double strength continuous integral stiffener on all sides for added strength.

BACK: Galvanized steel.

MIRROR: First quality ¼" float glass, thermosetting infrared cured paint backing with Poly-Glaze protective finish. Manufactured in accordance with ASTM C 1036 and ASTM C 1503. All edges protected by shock-absorbing, neoprene tubing. The back of the mirror is protected by a sheet of 1/4" extruded polystyrene, which is placed between the mirror and the galvanized steel.

MOUNTING BRACKETS: 18 gauge cold rolled steel.

Installation

Verify all rough-in dimensions prior to installation. Secure concealed mounting bracket to wall with screws (not included) at holes provided. Mounting kits available through Bradley (ref. #899-026). For more information, visit bradleycorp.com. Provide in-wall backing at mounting screw locations. Position mirror over mounting bracket to engage hanger tabs Slide mirror down and lock into position.

Guide Specification

Mirror shall be framed with one-piece, roll-formed stainless steel with 3/4" face and neatly mitered corners. Double -strength continuous integral stiffener on all sides. Back of unit shall be galvanized steel. Separate brackets for concealed mounting. Mirror shall be of first quality 1/4" polished float glass, guaranteed for 15 years against silver spoilage and protected by shock-absorbing, neoprene tubing with Poly-Glaze protective finish.

Framed Mirror shall be Bradley Model 781-_____" W x_____" H (specify width and height).

ADA Compliant

- ☑ Consult local and national accessibility codes for proper installation guidelines.
- ☑ Conformity and compliance to local and national codes is the responsibility of the installer.

Optional Features

Features		Suffix
○	¼" tempered glass mirror in lieu of polished float glass mirror*	-2
○	Highly polished No. 8 architectural finish, 20 gauge stainless steel in lieu of polished float glass mirror	-4

*Either the Length (L) or the Width (W) must be greater than 25".

- ☑ An inherent characteristic of a manufacturing process for tempered glass is distortion which may vary from mirror to mirror.
- ☑ Stainless steel mirrors will differ in optic quality from glass mirrors.
- ☑ In larger sizes, stainless mirrors are subject to distortion and/or "oil canning" for which Bradley Corporation cannot accept responsibility.
- ☑ Bradley mirrors are not field interchangeable from horizontal to vertical or vice versa. Always specify width first.

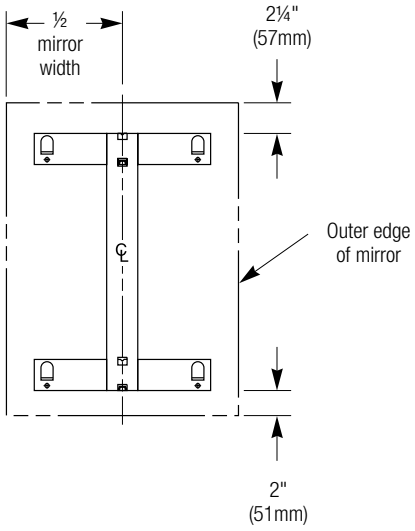
Orders composed of products indicated as ***BradEX®*** will be available to ship in three days after receipt of order at the factory. There is no pricing penalty for this service from Bradley.

This information is subject to change without notice.

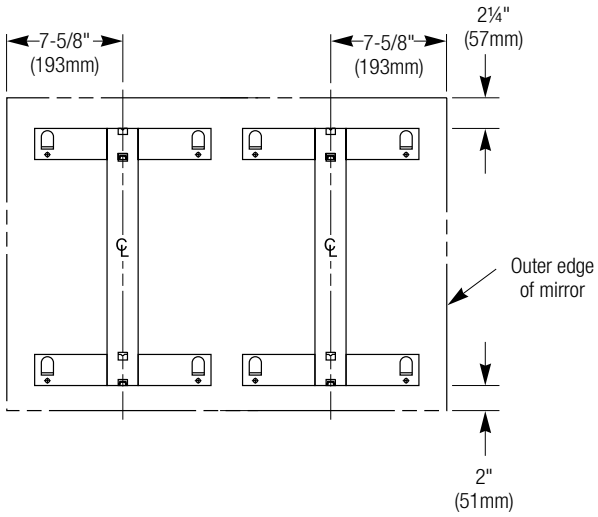
© 2024 Bradley
P.O. Box 309, Menomonee Falls, WI 53052-0309
800 BRADLEY (800 272 3539) +1 262 251 6000
bradleycorp.com

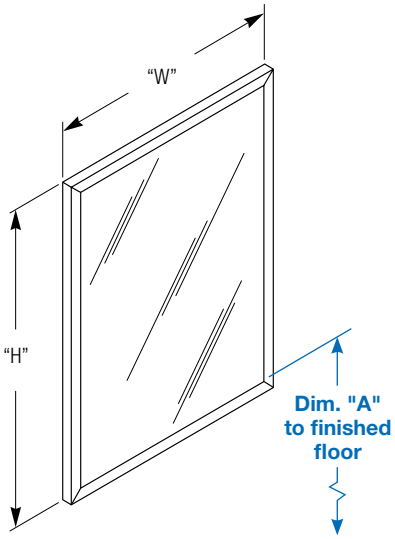
Dimensions

MIRRORS 30" WIDE AND UNDER



MIRRORS OVER 30" WIDE





Dim. "A" Key Surface:	For Dim. "A"	Bottom of Unit
Mirror's bottom edge of the reflecting surface to finished floor	40" (1016mm)	39¼" (997mm)
	37" (940mm)	36¼" (921mm)
	34" (864mm)	33¼" (845mm)
Rough wall opening:		
Surface Mount:	No rough wall opening, see overall dimensions	

BradEX® Models

Width (Inches) W	Height (Inches) H	Overall Dimension (Inches)	Overall Dimensions (Millimeters)	Standard Model Number
18"	24"	18 x 24	457 x 610	781-1824
18"	30"	18 x 30	457 x 762	781-1830
18"	36"	18 x 36	457 x 914	781-1836
18"	36"	18 x 36	457 x 914	781-18362
24"	30"	24 x 30	610 x 762	781-2430
24"	36"	24 x 36	610 x 914	781-2436
24"	36"	24 x 36	610 x 914	781-24362
24"	60"	24 x 60	610 x 1524	781-2460
24"	48"	24 x 48	610 x 1219	781-2448
36"	36"	36 x 36	914 x 914	781-3636
Model 781 series channel-framed mirrors can be fabricated to fit a maximum size of 120"W x 72"H.				

Orders composed of products indicated as ***BradEX***® will be available to ship in three days after receipt of order at the factory. There is no pricing penalty for this service from Bradley.

View Latest Version

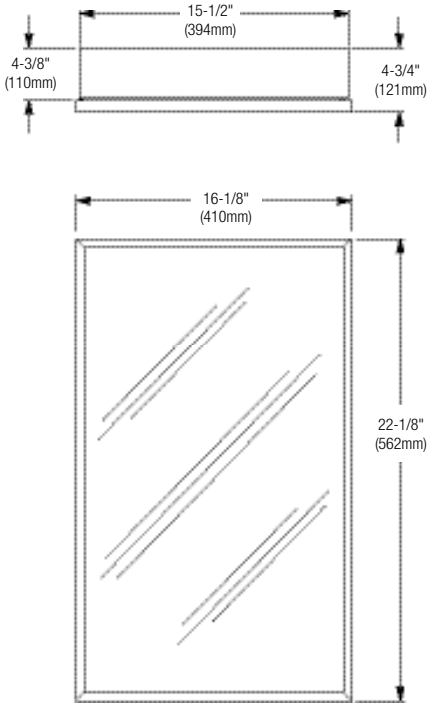
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bradleycorp.com

9664

Medicine Cabinet

- ☑ Surface-Mounted
- ☑ Two Adjustable Shelves
- ☑ Reversible
- ☑ ***Bradex®***





Product Materials

CABINET: heavy-duty steel construction, finished with rust-resistant, baked-on enamel after welding. Adjustable shelf supports.

DOOR: heavy-duty steel, finished with rust-resistant, baked-on enamel to match cabinet, equipped with full-length piano hinge with built-in door stop, protective door bumpers, and a magnetic catch.

MIRROR: 2mm thick float glass, electrolytically copper-backed, with full surround stainless steel frame with positive screw closure. One-year warranty.

SHELVES: (2) pre-painted metal. Adjustable.

Operation

Cabinet is reversible for left or right hand door swing.

Installation

Verify all rough-in dimensions prior to installation. Cabinet to be secured to wall with mounting screws (included) through holes provided.

Guide Specification

Surface-mounted medicine cabinet shall be fabricated of heavy-duty steel construction finished with baked-on enamel. Swing door shall have mirror with full surround stainless steel channel frame with screw enclosure. Cabinet shall be equipped with two fixed shelves, full-length piano hinge, and magnetic catch. Cabinet shall be reversible for left or right hand door swing.

Orders composed of products indicated as ***Bradex®*** will be available to ship in three days after receipt of order at the factory. There is no pricing penalty for this service from Bradley.

This information is subject to change without notice.

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bradleycorp.com

Exclusive

1.3k

Franklin Brass

Futura 24 in. Wall Mount Towel Bar Bath Hardware Accessory in Polished Chrome

4.5 (1075) Questions & Answers (42)










Hover Image to Zoom

Share Print

SHOP FATHER'S DAY GIFTS

$15.98

- Franklin Brass 24 in. bathroom towel bar in polished chrome
- Bathroom accessory made from zinc to resist rust and tarnishing
- Towel holder features concealed mounting hardware
- View More Details

Pleasant Ridge Store

✓ 4 in stock Aisle 32, Bay 014

Color/Finish: **Polished Chrome**

Bar Length (in.): **24**

18 | **24** | 30

Pack Size: **1**

1 | 2

Bath Accessory Type: **Towel Bar**

Toilet Paper Holder | **Towel Bar** | Towel Ring

Pickup at Pleasant Ridge Delivering to 45213

Pickup
Today
4 in stock
FREE

Delivery
Tomorrow
128 available
FREE

Get it delivered Today for $2.99. Schedule your delivery in checkout.

Internet # 100046939 Model # D2408PC Store SKU # 137011

Exclusive

1.1k

Franklin Brass

Futura Wall Mount Spring Loaded Toilet Paper Holder Bath Hardware Accessory in Polished Chrome

4.5 (567) Questions & Answers (18)



Hover Image to Zoom

Share Print

SHOP FATHER'S DAY GIFTS

$10.98

- Franklin Brass spring toilet paper holder in polished chrome
- Bathroom accessory made from zinc to resist rust and tarnishing
- Toilet paper holder features concealed mounting hardware
- View More Details

Pleasant Ridge Store

✓ 9 in stock Aisle 32, Bay 014

Color/Finish: **Polished Chrome**

Pack Size: **1**

1 2

Bath Accessory Type: **Toilet Paper Holder**

Toilet Paper Holder Towel Bar Towel Ring

Pickup at Pleasant Ridge Delivering to 45213

Pickup
Today
9 in stock
FREE

Delivery
Tomorrow
141 available
FREE

Get it delivered Today for $2.99. Schedule your delivery in checkout.

Need a Pro? We Can Help!
Get Referred to a Local Pro

9B1 Series
Elvari™ Coat/Robe Hook

Key Features

- High quality and modern style complements other Elvari™ products
- Robust 14-gauge design
- 50 lb load rating
- No visible welds or mounting hardware
- Common mounting, interchangeable hardware between single and double hooks

Guide Specification

Surface-mounted hook shall be fabricated of 14-gauge, 300 series stainless steel in a brushed #3 satin finish or optional electrocoat finishes. Fasteners, set screws, and hex key included.

Overall Dimensions - Single Hook:
2-3/4" H x 1-3/16" W x 1-11/16" D (69mm x 30mm x 42mm)

Overall Dimensions - Double Hook:
5-3/8" H x 1-3/16" W x 1-3/4" D (136mm x 30mm x 44mm)

MasterFormat Title: Commercial Toilet Accessories
MasterFormat Number: 10 28 13.13

OmniClass Title: Toilet and Bath Specialties
OmniClass Code: 23.31.25.00

Complementary Bradley Products

- Euro Style Partitions – Highrise Series
- Euro Style Partitions – Skyline Series
- Euro Style Partitions – Float Series
- Euro Style Partitions – Lucent Series
- Euro Style Partitions – Loft Series



9B1-1100
Single Hook



9B1-1102
Double Hook

Finishes

☑ *Click on any color swatch to view as a larger image.*

- Brushed Black*
- Brushed Brass*
- Brushed Bronze*
- Brushed Nickel*
- Brushed Stainless*
- Satin Stainless

*Electrocoat Finishes, see Optional Electrocoat Finishes section on page 2.

Product Compliance

Listed by UL Environment to

- GreenGuard Gold

For information on Warranties, Maintenance and BAA/ARRA Compliance, visit our website at: bradleycorp.com/washroom-accessories-products

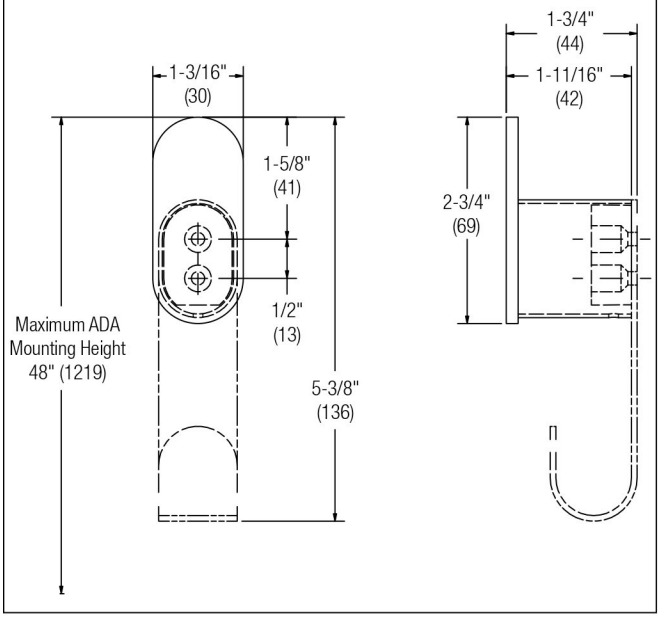
Orders composed of products indicated as ***BradEX***® will be available to ship in three days after receipt of order at the factory. There is no pricing penalty for this service from Bradley.

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9B1 Series
Elvari™ Coat/Robe Hook

Dimensions (mm)



Models (Must select one)

○ **9B1**	Elvari Coat/Robe Hook

Standard Selections (Must select one from each category)

Mounting (select one)

○ **11**	Surface Mounted

Hooks (select one)

○ **00**	Single Hook
○ **02**	Double Hook

Hook Finish Type (Must select one)

○ **BB**	Brushed Black
○ **BR**	Brushed Brass
○ **BZ**	Brushed Bronze
○ **BN**	Brushed Nickel
○ **BS**	Brushed Stainless
○ **SS**	Satin Stainless [1]

[1] Models with Hook Finish Type SS are available with ***BradEX***® expedited shipping.

Optional Electrocoat Finishes

Bradley offers an exclusive, proprietary electrocoat color process on the Elvari coat/robe hook models. Unlike powder coating, color is applied to the entire stainless steel part using a submersion process with electrically charged particles. This process results in a precise film thickness across all surfaces, allowing the grain of the stainless steel to show through.

Electrocoat provides complete coverage to the part and has environmental advantages such as no or low-VOC and HAPs (Hazardous Air Pollutants), heavy metal-free products, and minimum waste discharge. Bradley's electrocoat is durable and easy to clean as well as fingerprint, stain and corrosion resistant. A UV light stabilizer additive enhances resistance to weathering and color fade.

Products are performance tested for adhesion following ASTM D3359-22 and impact resistance following ASTM D2794.

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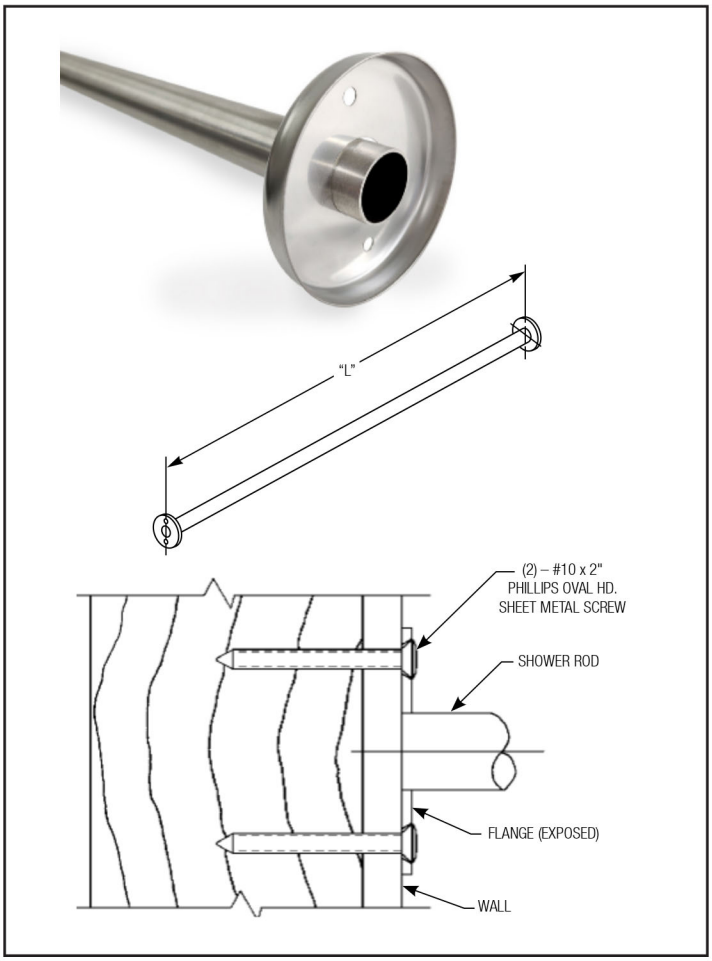
953, 9531

Shower Curtain Rod

☑ Exposed Mounting

☑ Model 953 – 1" O.D.
- ○ 36" ***Bradex***®
- ○ 42"
- ○ 48" ***Bradex***®
- ○ 60" ***Bradex***®
- ○ 72" ***Bradex***®

☑ Model 9531 – 1¼" O.D.
- ○ 36" ***Bradex***®
- ○ 42" ***Bradex***®
- ○ 48" ***Bradex***®
- ○ 60" ***Bradex***®
- ○ 72"



Product Materials

FLANGES: 22 gauge stainless steel. One-piece drawn construction with exposed surfaces in architectural satin finish.

TUBING: 18 gauge stainless steel, seamless construction with exposed surfaces in architectural satin finish.

Installation

Verify all rough-in dimensions prior to installation. To properly engage rod in support flanges, rod length must be no less than approximately ¼" shorter than wall opening. Secure one flange to wall with mounting screws (included) at holes provided. Align mounting holes vertically. Slip opposite flange over rod and secure to opposite wall with rod in place.

Guide Specification

Shower curtain rod shall be fabricated of 18 gauge stainless steel in satin finish. Flanges shall be of 22 gauge stainless steel.

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View Latest Version

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Product Materials

FLANGES: 3" dia. 12-gauge stainless steel.

ESCUTCHEONS: 14-gauge stainless steel. One-piece drawn construction with exposed surfaces in architectural satin finish. Snap over flanges to conceal mounting screws.

TUBING: 1½" O.D. 18-gauge stainless steel, seamless construction with exposed surfaces in architectural satin finish. Bent ends of tubing pass thru the flanges and are welded for maximum strength. Intermediate supports are contour cut and joined by welding to form an integral part of the grab bar. All exposed welds ground and polished to blend. Mandrel bending process maintains uniform bar diameter. Return provides 1½" standard safety clearance between wall and bar.

Strength

When properly mounted, all Bradley heavy-duty grab bar systems meet or exceed the requirements of ANSI Standard A117.1, the ADA and ABA Accessibility Guidelines for Buildings and Facilities (ADAAG), and the Uniform Federal Accessibility Standard (UFAS). All 812 grab bars are rated to support up to 250 pounds. Wall must be reinforced in the area of the grab bar in order to support the load it is intended to support.

Guide Specification

Grab bar shall be fabricated of stain finish stainless steel with concealed mounting flanges in sizes and configurations as indicated. Partition mounting kits are available.

Installation

For instructions on installation, warnings, and maintenance, please visit www.bradleycorp.com.

General-purpose mounting screws are provided; however, installers are advised to use the appropriate fasteners based on the specific substrate to ensure secure mounting.

Product Compliance

Complies with

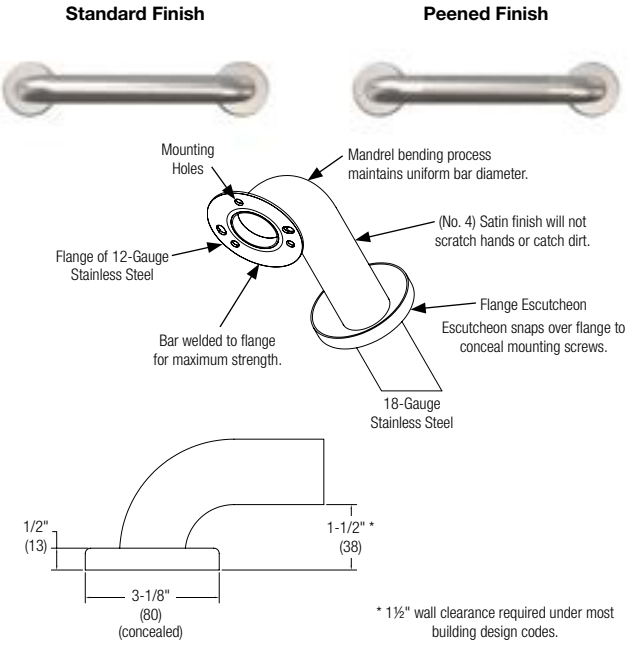
- ADA
- ADAAG
- ICC ANSI A117.1
- UFAS

☑ Consult local and national accessibility codes for proper installation guidelines.

☑ Conformity and compliance to local and national codes is the responsibility of the installer.

Optional Features

Features		Suffix
○	Peened Finish	-2



Bradex® Models

Configuration Number	Shipping Data		Finish Options	
	Cu. Ft.	Wt. Lb.	Satin	Peened
001-12"	0.13	2	X	X
001-18"	0.14	2	X	X
001-24"	0.14	3	X	X
001-30"	0.15	3	X	X
001-36"	0.15	3	X	X
001-42"	0.15	4	X	X
001-48"	0.25	4	X	X
001-54"	0.54	6	X	X
Models **not listed** in the chart require an additional lead time of 3–4 weeks.				

Standard Models

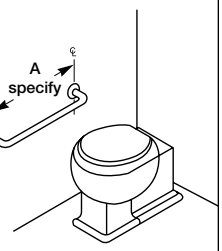
Configuration Number	Shipping Data		Finish Options	
	Cu. Ft.	Wt. Lb.	Satin	Peened
054 (30" X 30")	2.50	5	X	
056 (18" X 33")	1.30	5	X	
057 (30" x 30")	2.10	5	X	
058 (18" x 30")	1.40	5	X	
058 (24" x 36")	2.10	6	X	
058 (42" x 54") *	8.40	10	X	
NOTE: These units must ship via common carrier. * 058 (42" x 54")				

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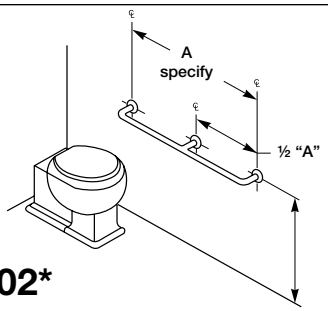
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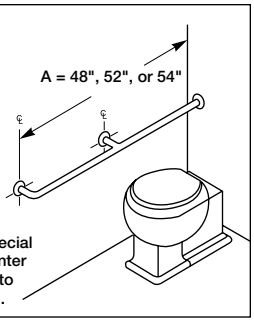
Typical Water Closet Applications



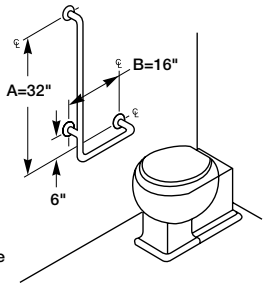
001*
Specify length desired. See **048** and **049** for 45° mounting. **001** over 54" requires a center support and becomes **002**.



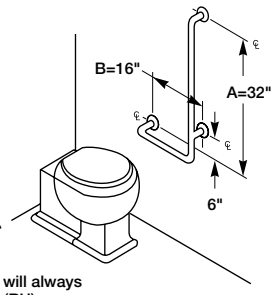
002*



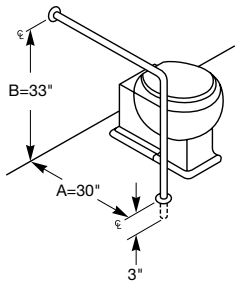
003*
Only one end return. Special size "A" dimensions; center post will only be added to models greater than 24".



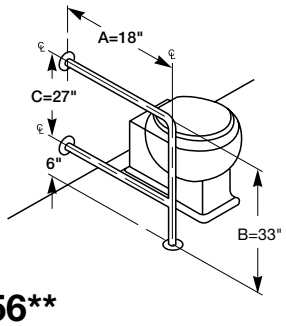
005*
"A" dimension will always have stand-off (LH).



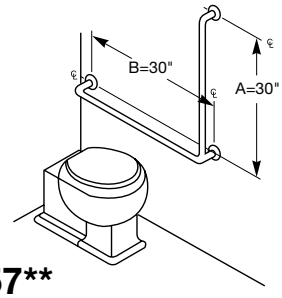
006*
Opposite **005**.
"A" dimension will always have stand-off (RH).



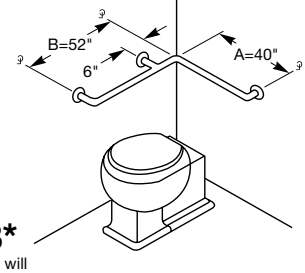
054*
30" x 33"
NOTE: 1" not available for this application.



056**
24" x 24"



057**
30" x 30"
NOTE: Not available with 817 Series grab bars.



058*
(LH) "B" side will have stand-off.
LH & RH

* Customizable

** Non-customizable

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○ Model 259 — Surface-Mounted

☑ Roll Paper Towels

Product Materials

BRACKET: die-cast aluminum.

SPINDLE: die-cast aluminum with stainless steel spring.

Capacity

One roll standard core paper towels to 6" diameter.

Operation

Remove tissue roll core to access special locking mechanism for servicing. Stops on spindle control paper delivery. Spindle revolves only one-half turn for each dispensing operation and returns to original position.

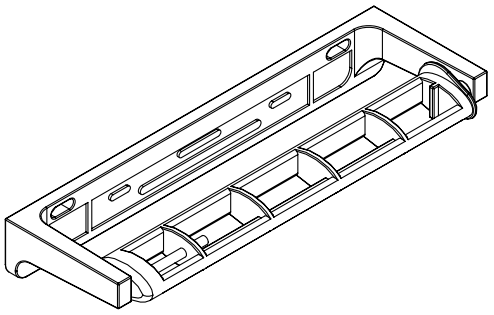
Installation

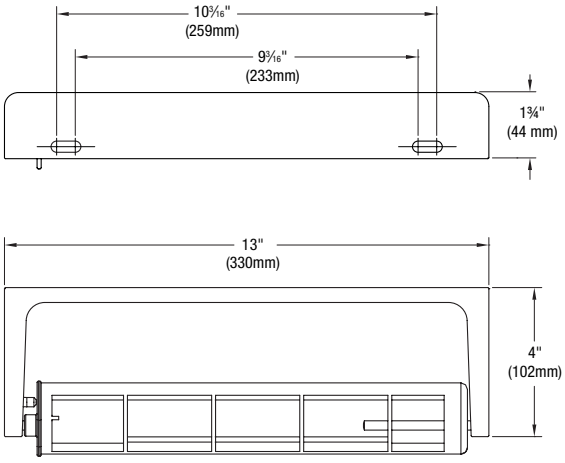
Verify all rough-in dimensions prior to installation. Secure to wall with mounting screws (included) at holes provided.

Guide Specification

Surface-mounted roll paper towel dispenser shall be die-cast aluminum with satin finish, accommodate one standard core paper towel roll and include a controlled delivery mechanism.

Overall dimensions: 13"W x 1¾"H x 4"D.





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○ Model 505 — *Bradex*®

- ☑ Controlled Delivery
- ☑ Single Roll (For Dual Roll see Model 522)

Product Materials

UNIT: diecast zinc. Copper and nickel polished chrome-plated finish.

Capacity

One standard core toilet tissue roll through 5" in diameter and 4½" wide.

Operation

Push button unlocks support arms to permit servicing of unit. Tension spring on stationary arm controls paper delivery.

Installation

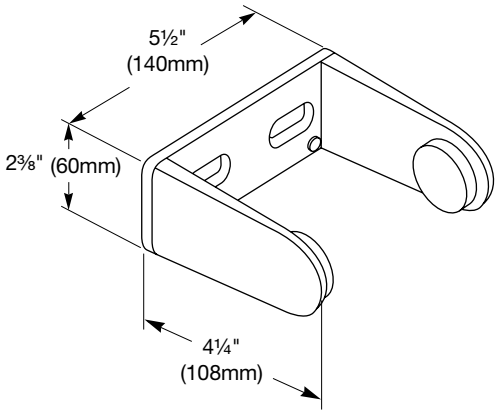
Verify all rough-in dimensions prior to installation. Secure to wall with mounting screws (included) at holes provided.

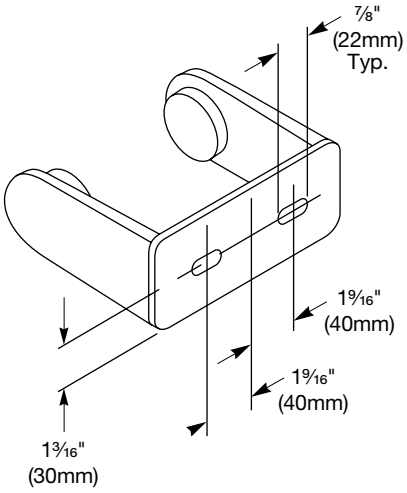
Guide Specification

Surface-mounted toilet tissue dispenser shall be chrome-plated diecast zinc and hold one standard core toilet tissue roll. Tension spring controls paper delivery.

Overall dimensions: 5½"W x 2⅜"H x 4¼"D.







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Your Product

GOJO TFX Automatic Wall Mounted Hand Soap Dispenser, Dove Gray (2740-12)

35

$56.09

Selected

+



Clearance

Brighton Professional Foaming Hand Soap Refill for TFX Dispenser, Cranberry Scent, 40.6 oz., 2/Carton...

3

$67.66 $107.39

Selected

+



Duracell Coppertop C Alkaline Batteries, 4/Pack (MN1400R4ZX)

309

$10.39

Selected

+



Scott Essential High Capacity Hardwound Paper Towels, 1-Ply, 950 ft./Roll, 6 Rolls/Carton (02000)

18

$97.99

Selected

Add 4 to cart

Details | Specifications | Reviews | Q&A

About this product

Create a healthier environment for the people in your facility with the GOJO TFX Touch-Free Dispenser for GOJO TFX Foam Soap Refills

Built on over 65 years of dispenser engineering experience, the durable GOJO TFX Touch-Free Dispenser helps you keep your restrooms clean and shows you care about the well-being of people in your facility. With millions of units installed, TFX dispensers and refills are designed to be easy to maintain and are guaranteed to be reliable. Simply place your hand under the dispenser, and the perfect amount of foam soap appears. The window shows when it is time for a new refill. The TFX dispenser works with GOJO TFX foam soap refills. Each 1200 mL refill holds up to 2000 uses of soap, which minimizes change outs. Refills are SANITARY SEALED with a fresh dispensing valve to lock out germs. GOJO self-lathering foam soap rinses cleaner than liquid soap without leaving drips or messes in the sink, reducing the time to clean sink areas.

- Built on 65 years of dispenser engineering experience, the GOJO TFX Touch-Free Dispenser helps you keep your restrooms clean and shows you care about the well-being of the people in your facility
- Simply place your hand under the dispenser, and the perfect amount of foam soap appears. The convenient window shows when it is time for a new refill
- With millions of units installed, across billions of uses, TFX dispensers and refills are designed to be easy to maintain and are guaranteed to be reliable
- The TFX Soap Dispenser works with GOJO TFX Foam Soap Refills. Each 1200 mL refill holds up to 2000 uses of soap, which minimizes changeouts. Refills are SANITARY SEALED to lock out germs
- Includes: 1 - GOJO TFX Touch-Free Soap Dispenser, Dove Grey, for 1200 mL GOJO TFX Foam Soap Refills, adhesive mounting tape. Dispenser requires 3 "C" Alkaline batteries that are not included
- This product is manufactured by a certified WBE (Women Owned Business)
- Holds a large, 1200 ml refill
- Dispenser features a skylight with an extra-large site window that makes it easy to see when it's time to reload
- Fully ADA compliant
- Gray
- Batteries Not Included
- Compatible refill model numbers: 5361-02, 5665-02, 5665-02, 5362-02, 5369-02

Show you care about the well-being of the people in your facility with the GOJO TFX Touch-Free Dispenser for GOJO TFX Foam Soap Refills. Built on over 65 years of dispenser engineering experience, the durable GOJO TFX Touch-Free Dispenser helps you keep your restrooms clean. With millions of units installed, across billions of uses, TFX dispensers and refills are designed to be easy to maintain and are proven reliable. Simply place your hand under the dispenser, and the perfect amount of foam soap appears. The convenient window shows when it is time for a new refill. The TFX Soap Dispenser works with GOJO TFX Foam Soap Refills. Each 1200 mL refill holds up to 2000 uses of soap, which minimizes changeouts. Refills are SANITARY SEALED with a fresh dispensing valve to lock out germs. GOJO self-lathering foam soap rinses cleaner than liquid soap without leaving drips or messes in the sink, reducing the time to clean sink areas. GOJO soap varieties include: GOJO Premium Foam Handwash with Skin Conditioners (5361-02), GOJO Green Certified Foam Hand Cleaner (5665-02), GOJO Premium Foam Antibacterial Hand Wash (5362-02), GOJO E2 Foam Sanitizing Soap (5364-02) and GOJO E2 Foam Handwash with PCMX (5369-02). Case Includes: 1 - GOJO TFX Touch-Free Soap Dispenser, Dove Grey, adhesive mounting tape. Dispenser requires 3 "C" Alkaline batteries that are not included. Dispenser dimensions are: 10.58 h x 4.09 w x 6.0 l. TFX Soap refills are sold separately (5361-02, 5665-02, 5362-02, 5364-02, 5369-02). GOJO Industries is a purpose-driven Family Enterprise committed to making easier, more effective and gentle for us to clean our hands.

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The Industry Leader in Quality Mailboxes!
SALSBURY INDUSTRIES
Manufacturing Since 1936

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10% OFF & FREE
Web Specials!

View all products



Salsbury Vertical Mailbox - 4 Doors - Sandstone - Surface Mounted - USPS Access

Model # 3504SSU

IN STOCK
Usually ships within 1-2 days

~~$500.00~~

$450.00
Sale Price!

Free Shipping on all orders over $5,000!

Color: Sandstone

Volume Discounts	
Quantity	**Price**
2 - 5	**$405.00**
6 +	**$385.00**
› Contact Us for Bulk Pricing	

Size: 24.25" W x 19" H x 7.5" D

Weight: 30 lbs

Quantity: 1 Add To Cart

4B+ Vertical Mailboxes are USPS approved for replacement installations. For new construction, see Cluster Box Units and 4C Horizontal Mailboxes.

Related Items







Custom Engraved Self Adhesive Placard - for Vertical Mailbox Door (Model # 3567)

Outgoing Mail Slot Option - On Far Left Door of Vertical Mailbox (Model # 3569)

Standard L Replaceme Salsbury V Mailbox Do 2 Keys per I Pack (Model # 3

More Information

Salsbury 3500 Series 4B Vertical Mailboxes - Surface Mounted - U.S.P.S. Access

Features:

- 4B Vertical mailboxes are U.S.P.S. approved for replacement and/or retrofit installations
- Manufactured by Salsbury Industries to USPS-STD-4B Specifications
- Ideal for apartments, condominiums and commercial buildings
- Made entirely of aluminum
- Feature a durable powder coated finish available in aluminum, bronze and sandstone
- Mount directly to a wall and are secured with mounting hardware (not included)
- Individual compartment size is 5-1/2" W x 16-1/4" H x 6-3/4" D
- Doors and trim are striated to resist scratching
- Doors include a 5 pin cylinder cam lock (with 2 keys)
- Mailboxes are available with 3 to 7 compartments
- Salsbury Industries is an ISO 9001:2015 certified company and has excelled in the field of manufacturing since 1936

Options:

- Custom engraved placards
- Outgoing 4-3/4'' W x 1/2'' H mail slot
- Replacement locks
- Additional keys
- Key blanks

Downloads:

More Product Information

Installation Instructions

Technical Drawing

Specifications

Videos:

Vertical Mailbox Video



ARCHITECTURAL SIGNAGE

Savannah™ Collection

(Sign shown uses ¾" H text size)



Collection: Savannah™ Collection

Face Plate: Pebble Gray 0387

Back Plate: Black 0152

Accent: N/A

Font: ADA Arial

Text Color: Black 29920

Sign Material: Acrylic

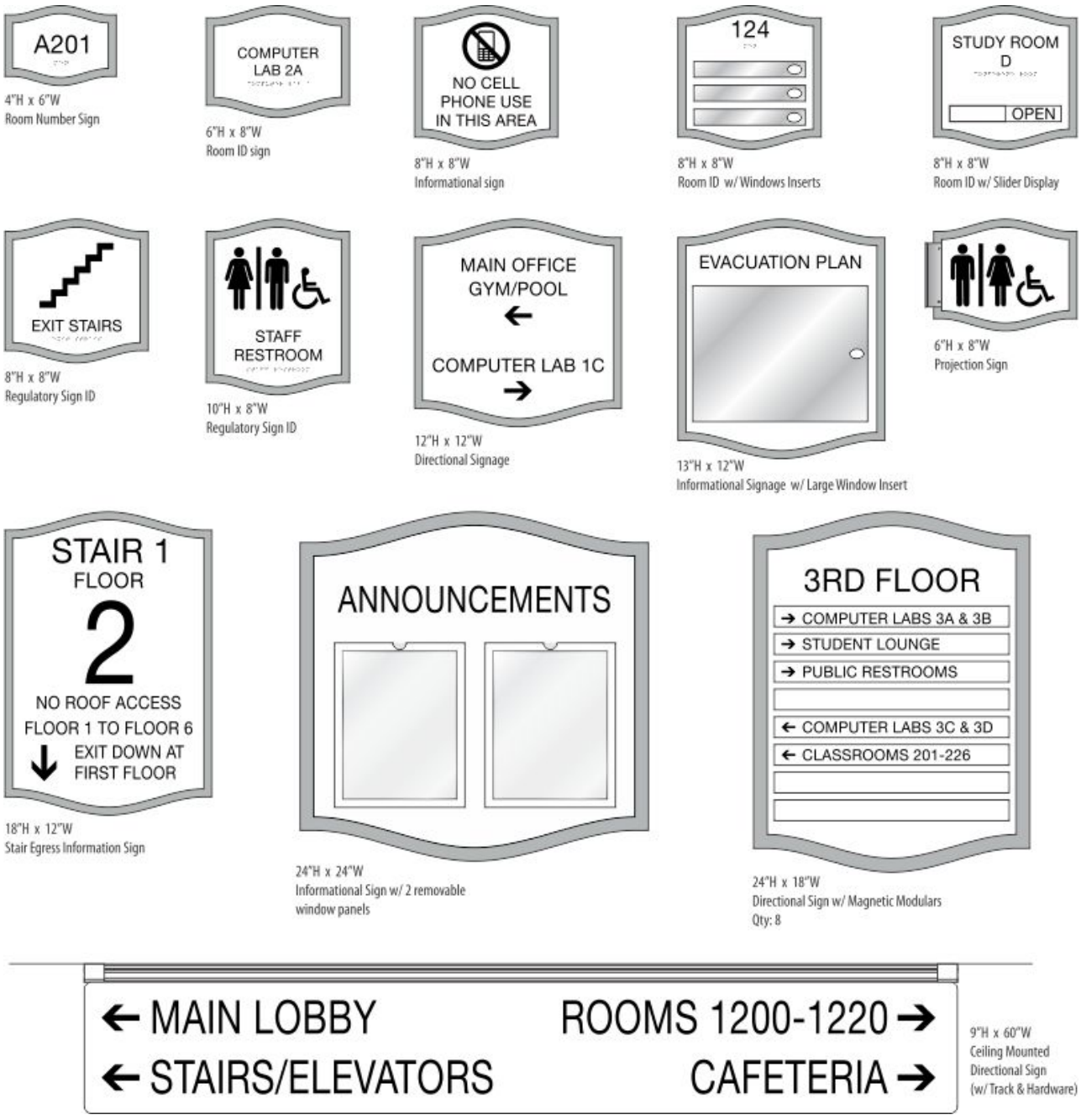
Sign Size: 6" H X 8" W

inpro

World Headquarters, S80 W18766 Apollo Drive, Muskego, WI 53150. Ph 800.222.5556

ARCHITECTURAL SIGNAGE

Additional Signs available in the Collection



Other sign sizes and colors are available. Please contact your sales representative for more information.
Disclaimer: To ensure color matching, please order a color sample from
https://www.inprocorp.com/colors-and-fabrics/

inpro.
World Headquarters, S80 W18766 Apollo Drive, Muskego, WI 53150. Ph 800.222.5556

#1 Home Improvement Retailer

Pleasant Ridge 10PM 45213 Wh Pleasant Ridge 10PM 45213 Shop All Services DIY Log In

... / Window Treatments / Blinds / Mini Blinds / Aluminum Mini Blinds

Internet # 303200062 Model # 10793478518944 Store SKU # 1002779184

White Cordless Aluminum Mini Blinds for Windows with 1 in. Slats - 35 in. W x 72 in. L(Actual Size 34.5 in. W x 72 in.L)

45

(1551) Questions & Answers (149)

Feedback










Hover Image to Zoom

Share Print

VANITY 2 DRAWER BASE CABINETS

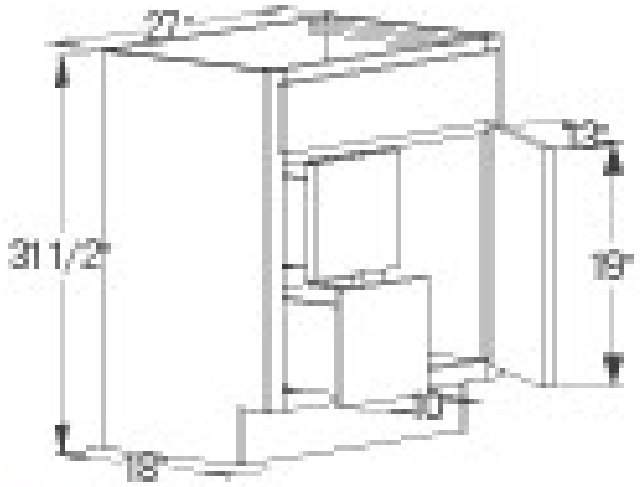
- Includes two hinges per door.
- Shelf not included; cabinet not drilled for shelves.
- 18" altered depth modification available.
- 34½" height modification available.

18" Deep, 31½" High

SINGLE DOOR

2 Drawers

VS2D2418	L or R
VS2D2718	L or R
VS2D3018	L or R
VS2D3318	L or R
VS2D3618	L or R



BUTT D

2 Drawers

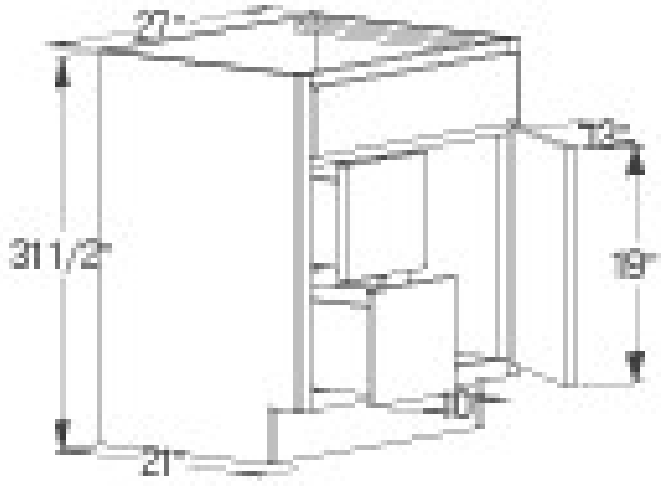
VS2D4218B	
VS2D4518B	
(2 False Fronts	
VS2D4818B	
(2 False Fronts	

21" Deep, 31½" High

SINGLE DOOR

2 Drawers

VS2D24	L or R
VS2D27	L or R
VS2D30	L or R
VS2D33	L or R
VS2D36	L or R



BUTT D

2 Drawers

VS2D42B	
VS2D45B	
(2 False Fronts	
VS2D48B	
(2 False Fronts	



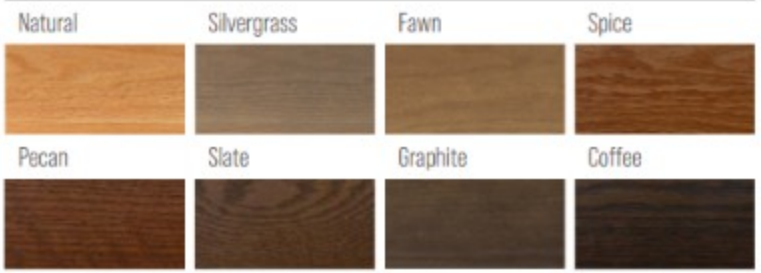
DOVER



Style	Veneer Flat Panel
Drawer	Slab
Overlay	Standard
Edge Profile	Reverse Bevel
Wood Type	Oak
Door Rail	2 ¼" Rail

Printed colors are for representation only. Order samples for accurate color matching.

STAIN



Add to Board







LivingStone

Caldera

Assigned Rep
Troy Lyons

Contact

Add to Cart

Usage	Delivery	Price Range	SKU
Commercial, Residential	FedEx Priority Overnight	$	L805

Materials: Surfaces/Resin; Surfaces/Solid Surface

Collection Name: Elements

Sample Size: 3.9 in x 1.55 in

Size: 144in x 30in

Availability: Typically Stocked, Stocked in North America

Warranty: 15-Year Limited Transferable

Characteristics

Technical

Format: Modular, Panel / Sheet

Total Weight: 130 lbs

Overall Thickness: 1/2in

Recommended Grout: Artisan Joint Adhesive – ART100 Off White

Maintenance

Application

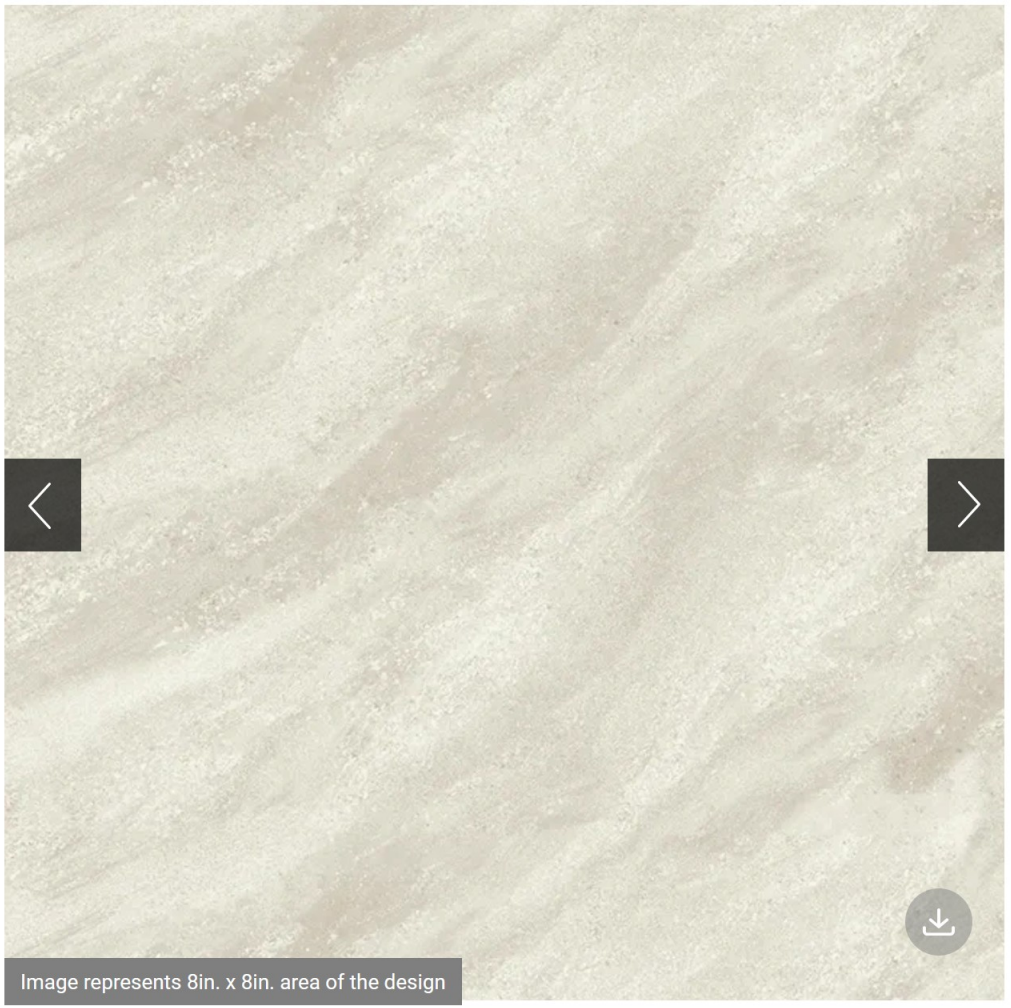
Performance

Environmental

Climate Impact: ISO 14001, LEED Compliant

Human Health Impact: Low Emitting/Low VOC, NSF/ANSI 51 Certified, UL GREENGUARD

LEED: May contribute to LEED credits



5044

Beachwalk

In Stock Design

Beachwalk is a tonal warm white directional stone with texture interest and sweeping movement.

- Design Repeat (Width X Length): 89.8" X 49.2"

Finish: **60 MATTE**
Finish option availability is dependent on the selected laminate product type

Order a sample

Free Standard Shipping in 7–10 business days. For expedited shipping, please call Customer Support at 1-800-433-3222.

Standard Laminate | 60 Matte

Size | Qty

ORDER A SAMPLE

#1 Home Improvement Retailer

Pleasant Ridge 10PM 45213 Wh Pleasant Ridge 10PM 45213 Shop All Services DIY Log In

Home / Hardware / Cabinet Hardware / Drawer Pulls

Internet # 300823363 Model # HH075328-SS Store SKU # 1004677109

143

HICKORY HARDWARE

Skylight Collection 5-1/16 in. Modern Stainless Steel Bar Pull Handle for Kitchen, Bathroom, Furniture (1-Pack)

(208) Questions & Answers (33)

Feedback









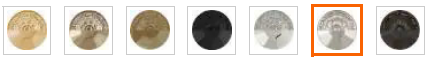

Hover Image to Zoom

Share Print

$7 43

- Contemporary metal design with a durable, stainless steel finish
- 5 in. center-to-center (distance between the drill holes)
- Screws included for easy installation
- View More Details

Finish: **Stainless Steel**



Center to Center Measurement (in.): **5 1/16 in.**

3 in. | 3 3/4 in. | **5 1/16 in.** | 6 5/16 in. | 8 13/16 in. | 12 in. | 18 in.

Package Quantity: **1**

1 | 5 | 10

Pickup at Pleasant Ridge Delivering to 45213

Ship to Store
Jul 25 - Jul 30
68 available
FREE

Delivery
Tomorrow
68 available
FREE

Need a Pro? We Can Help!
Get Referred to a Local Pro

☐ Add Pro Referral

ⓘ What to Expect

— 1 +

Add to Cart

PayPal

Pay in 4 interest-free payments on purchases of $30-$1,500 with PayPal. Learn more

Free & Easy Returns In Store or Online
Return this item within **90 days** of purchase.
Read Return Policy

Feedback

Frequently Bought Together

CURRENT ITEM

Select



HICKORY HARDWARE
Skylight Collection 5-1/16 in. Modern Stainless Steel Bar Pull Handle for Kitchen, Bathroom, Furniture (1-Pack)

(4.7 / 208)

$7.43

Select



HICKORY HARDWARE
Skylight Collection 1-1/4 In. Square Knob Modern Stainless Steel Decorative Drawer, Kitchen, Bathroom (1-Pack)

(4.8 / 60)

$5.99

Select



Amerock
Versa 1-3/8 in. (35mm) Modern Satin Nickel Round Cabinet Knob

(4.9 / 57)

$3.52

1/1

Subtotal: $16.94

Add 3 Items to Cart

Feedback

Ask about this product

Get an immediate answer with AI

Type a question

Get an Answer

AI-generated from the text of manufacturer documentation. To verify or get additional information, please contact The Home Depot customer service.

Product Details

About This Product

Hickory Hardware has been in business for more than 120 years and is a division of Belwith Products, an industry-leading brand in decorative and functional products. The company's in-house designers and craftsmen are dedicated to providing complete home solutions, making Hickory Hardware a reliable & trusted brand for all your hardware needs.WE OFFER A VARIETY OF CABINET PULLS: Hickory Hardware offers a variety of choices for upgrading your kitchens, bathrooms, dressers, vanities and more. With different styles and length options, our pulls can fit any size cabinet or drawer and add the custom touch to your space.TRADITIONAL AND CLASSIC ROUND KNOBS: Whether you prefer modern and bold or a more traditional & classic look, our 50+ collections come in a variety of shapes & styles in a multitude of sizes & finishes. These knobs are a popular option that adds a timeless charm to your cabinets & drawersHIGH QUALITY FEATURES:● Sleek & stylish design● Perfect for updating cabinet hardware● Comes with mounting hardware● Designed for cabinets & drawers● Mix & match different hardware styles● Customize your cabinets & drawersCUSTOMIZABLE HARDWARE OPTIONS: With dozens of collections to choose from, you can mix & match different hardware styles to create a unique look that suits your personal taste & home decor. With a variety of sizes & finishes, you can easily customize your cabinets & drawers to your liking. Most of our collections come in multipacks to allow for savings!

Highlights

- Designed in the USA since 1893: Our designers in Grand Rapids, Michigan, have created over 50 unique collections, so you can mix and match pulls, cup pulls, and knobs for a stunning look

- Skylight collection: Inspired by contemporary kitchen design, this collection embodies balance and simplicity, so you can choose from various pull sizes and matching hooks for on-trend style
- Upgrade your kitchen cabinets: Our handles and knobs add sophistication and aesthetic appeal, which complements any decor style with elegant silhouettes
- Trusted cabinet handle quality: With over a century of experience, our team creates lasting products in classic to contemporary styles, which adds beauty and functionality to your space
- Ergonomically designed cabinet handles: Stylish and easy to use, our drawer pulls and knobs offer quick installation and a comfortable touch
- Versatile and timeless cabinet pull handles: Elevate the look of your kitchen with durable and classic hardware designed to stand the test of time
- Stylish kitchen drawer pulls and cabinet knobs: Choose from over 50 designs to add a contemporary touch to your cabinets, and visit our website for more information at www.hickoryhardware.com
- The Polished Nickel finish coordinates well with other polished nickel finishes, and the warm silver tone has a glossy protective coating and is highly reflective
- Center to Center: 5-1/16 Inch (128mm), Length: 5-7/16 Inch, Width: 3/8 Inch, Projection: 1-1/8 Inch
- Update the cabinets in your home by replacing door pulls. Check out our Project Guide to see how it's done.
- Return Policy
- California residents see Prop 65 WARNINGS

Feedback

Product Information

Internet # 300823363
Model # HH075328-SS
Store SKU # 1004677109

Additional Resources

Shop All HICKORY HARDWARE

From the Manufacturer

- Warranty
- Return Policy



Amerock Faircrest 1-1/4 in. (32mm)…

$9.99

Sponsored

Specifications

Dimensions: H 1.13 in, W 0.38 in, D 5.44 in

Dimensions

Center to Center Measurement (mm)	128
Product Depth (in.)	5.44 in
Product Height (in.)	1.13 in
Product Width (in.)	0.38 in
Pull Length (in.)	5.44 in
Pull Projection (in.)	1.13 in

Details

Builders Hardware Product Type	Cabinet Pull
Cabinet Pull Type	Bar Pull
Center to Center Measurement (in.)	5 1/16 in.
Features	Decorative
Finish	Stainless Steel
Hardware Color Family	Stainless Steel
Hardware Finish Family	Brushed
Material	Zinc
Package Quantity	1
Returnable	90-Day
Style	Contemporary

Warranty / Certifications

Manufacturer Warranty	Limited Lifetime

How can we improve our product information? Provide feedback.

Feedback

Questions & Answers

33 Questions

Customer Reviews

4.8 out of 5 (208)

Customers Also Viewed

Top Rated



Liberty (4-Pack) Solid Bar 3 in. (76 mm) Brushed Stainless Steel Modern Cabinet Handle Drawer Pulls

(4.8 / 4154)

$19.98

($5.00/pull)

Add to Cart

Exclusive



Liberty Mandara 5-1/16 in. (128 mm) Classic Satin Nickel Cabinet Drawer Bar Pull

(4.8 / 2815)

$6.48

Add to Cart



GLIDERITE 5 in. Center-to-Center Solid Square Slim Satin Nickel Cabinet Bar Pull (10-Pack)

(4.5 / 228)

$33.49

/package

($3.35/pull)

Add to Cart

#1 Home Improvement Retailer

Pleasant Ridge 10PM 45213 Wh Pleasant Ridge 10PM 45213 Shop All Services DIY Log In

... / Appliances / Ranges / Electric Ranges / Single Oven Electric Ranges

Internet # 322003823 Model # ACR4303MMS Store SKU # 1010028527 Store SO SKU #1008399

Amana

30 in. 4 Burner Element Freestanding Electric Range in Stainless Steel

(703) Questions & Answers (94)










Hover Image to Zoom

Feedback

Share Print

Front Control Electric Ranges

PRODUCT MODEL NUMBERS

WEC310S0L WEE515S0L WEE515SAL YWEE515S0L

ELECTRICAL CONNECTION

To properly install your range, you must determine the type of electrical connection you will be using and follow the instructions provided for it here.

- Range must be connected to the proper electrical voltage and frequency as specified on the model/serial/rating plate. The model/serial/rating plate is located behind the oven door on the top right-hand side of the oven frame.
- This range is manufactured with the neutral terminal connected to the cabinet. Use a 3-wire, UL listed, 40- or 50-amp power supply cord (pigtail). See the following Range Rating chart. If local codes do not permit ground through the neutral, use a 4-wire power supply cord rated at 250 volts, 40- or 50-amps and investigated for use with ranges.

Range Rating*		**Specified Rating of Power Supply Cord Kit and Circuit Protection**
120/240 Volts	**120/208 Volts**	**Amps**
8.8 - 16.5 KW	7.8 - 12.5 KW	40 or 50**
16.6 - 22.5 KW	12.6 - 18.5 KW	50

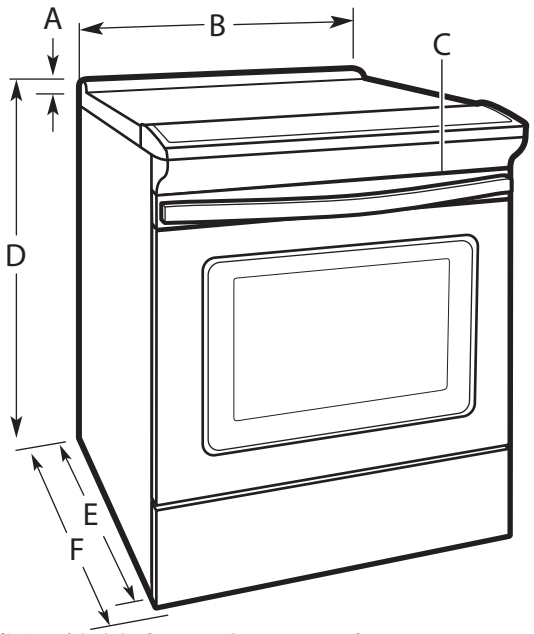
* The NEC calculated load is less than the total connected load listed on the model/serial/rating plate.

** If connecting to a 50-amp circuit, use a 50-amp rated cord with kit. For 50-amp rated cord kits, use kits that specify use with a nominal 1 3/8" (3.5 cm) diameter connection opening.

- A circuit breaker is recommended.

PRODUCT DIMENSIONS

This manual covers several models. Your model may appear different from the models depicted. Dimensions given are maximum dimensions across all models.



A. 1 3/16" (3.0 cm) height from cooktop to top of vent

B. 29 7/8" (75.9 cm)

C. Model/serial/rating plate (located behind the oven door on the top right-hand side of the oven frame)

*D. WEE515SAL: 34" (86.4 cm) height to top of cooktop edge with leveling legs screwed all the way in**
*Other models: 36" (91.4 cm) height to top of cooktop edge with leveling legs screwed all the way in**

E. 28 25/64" (72.1 cm) max. depth from front of console to back of range

F. 29 1/64" (73.7 cm) max. depth from handle to back of range

IMPORTANT: Range must be level after installation. Follow the instructions in the "Level Range" section of the Owner's Manual. Using the cooktop as a reference for leveling the range is not recommended.

* Range can be raised approximately 1" (2.5 cm) by adjusting the leveling legs.

Because Whirlpool Corporation includes a continuous commitment to improve our products, we reserve the right to change materials and specifications without notice.

Dimensions are for planning purposes only. For complete details, see Installation Instructions packed with product. Specifications subject to change without notice.

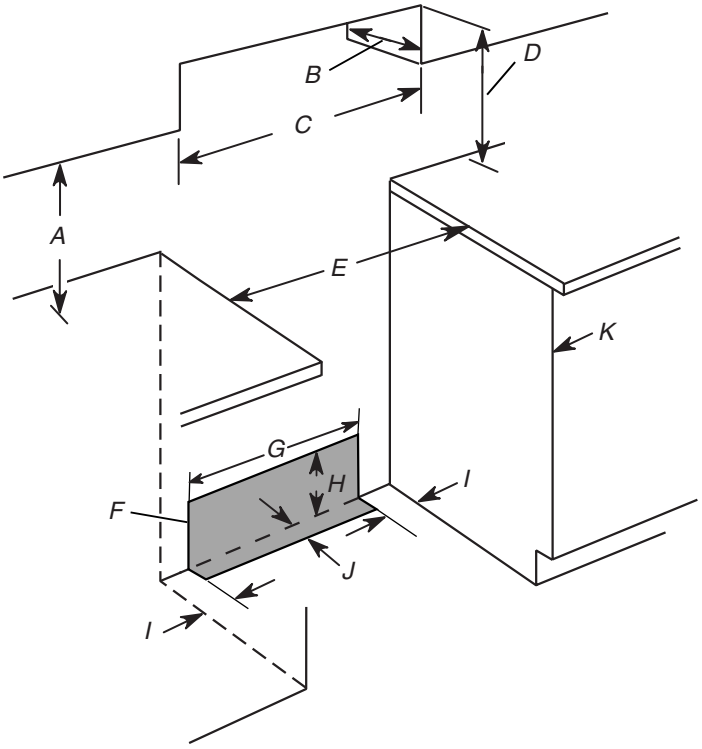
Ref. W11508843A
04/19/2021

CABINET DIMENSIONS

Cabinet opening dimensions shown are for 25" (64.0 cm) countertop depth, 24" (61.0 cm) base cabinet depth and 36" (91.4 cm) countertop height.

IMPORTANT: If installing a range hood or microwave hood combination above the range, follow the range hood or microwave hood combination installation instructions for dimensional clearances above the cooktop surface.

Range may be installed next to combustible walls with zero clearance.



A. 18" (45.7 cm) upper side cabinet to countertop
B. 13" (33 cm) max. upper cabinet depth
C. 30" (76.2 cm) min. opening width
D. For minimum clearance to top of cooktop, see NOTE.*
E. 30" (76.2 cm) min. opening width
F. The shaded area is recommended for installation of grounded outlet.
G. 13 1/8" (33.3 cm)
H. 7 11/16" (19.5 cm)
I. 4 13/16" (12.2 cm)
J. 3 11/16" (9.4 cm)
K. Cabinet door or hinges should not extend into the cutout.

* **NOTE:** 24" (61.0 cm) minimum when bottom of wood or metal cabinet is shielded by not less than 1/4" (0.64 cm) flame retardant millboard covered with not less than No. 28 MSG sheet steel, 0.015" (0.4 mm) stainless steel, 0.024" (0.6 mm) aluminum or 0.020" (0.5 mm) copper. 30" (76.2 cm) minimum clearance between the top of the cooking platform and the bottom of an uncovered wood or metal cabinet.

Because Whirlpool Corporation includes a continuous commitment to improve our products, we reserve the right to change materials and specifications without notice.

Dimensions are for planning purposes only. For complete details, see Installation Instructions packed with product. Specifications subject to change without notice.

Ref. W11508843A
04/19/2021

#1 Home Improvement Retailer

Pleasant Ridge 10PM 45213 Wh Pleasant Ridge 10PM 45213 Shop All Services DIY Log In

Home / Appliances / Range Hoods / Under Cabinet Range Hoods

Internet # 207189288 Model # JVX3300SJSS Store SKU # 1001878519 Store SO SKU #1001878

719

GE

30 in. Over the Range Convertible Hood in Stainless Steel

(902) Questions & Answers (114)



Hover Image to Zoom

Feedback

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Please let us know how we can improve better serve you.

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$178.00 Was ~~$219.00~~
Save $41.00 (19%)

Get up to $400 in Rebates for 45213

Pay **$153.00** after **$25 OFF** your total qualifying purchase upon opening a new card.
Apply for a Home Depot Consumer Card

- Easy Install within 10 minutes or less
- Two-speed, 200-CFM venting system removes odors and moisture
- Enjoy easy access and a subtle appearance with Front Controls
- View More Details

Color/Finish: **Stainless Steel**

Range Hood Size (Width): **30 in.**

24 in. | **30 in.** | 36 in.

Maximum Air Flow Capacity (CFM): **200 CFM**

200 CFM | 300 CFM

Unavailable at Pleasant Ridge

Delivering to 45213

Pickup
Unavailable

Delivery
Earliest delivery
Wed, Jul 23

Schedule your appliance delivery in checkout. Delivery cost applied in cart.

Add to Cart

Pay in 4 interest-free payments of $44.50 with PayPal.
Learn more

Feedback

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Please let us know how we can improve better serve you.

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Ask about this product

Get an immediate answer with AI

Type a question

Get an Answer

AI-generated from the text of manufacturer documentation. To verify or get additional information, please contact The Home Depot customer service.

Product Details

About This Product

At GE Appliances, we bring good things to life, by designing and building the world's best appliances. Our goal is to help people improve their lives at home by providing quality appliances that were made for real life. Whether it's enjoying the tradition of making meals from scratch or tackling a mountain of muddy jeans and soccer jerseys, GE Appliances are crafted to support any and every task in the home.

Highlights

- 2-speed, 200-CFM venting system - Removes smoke, grease, odors and moisture
- Front controls - Enjoy easy access and a subtle appearance
- Cooktop lighting - Illuminate cooking space and surrounding surface
- Convertible venting options - Select recirculating or external venting
- Vertical and rear exhaust - Exhausts from the top or rear of the hood
- Appearance (Partially enclosed bottom) - Enjoy easy access to hood interior
- Dishwasher safe filter - Filters grease and is dishwasher-safe
- Limited 1-year warranty entire appliance entire appliance entire appliance
- Click Here for details on the services included with Delivery & Basic Hook-up, Installation options for Major Appliances, and Appliance Return Policy Information
- Click here to shop more GE appliances
- California residents see Prop 65 WARNINGS

Product Information

Internet # 207189288
Model # JVX3300SJSS
Store SKU # 1001878519
Store SO SKU #1001878519

Additional Resources

Shop All GE

From the Manufacturer

- Warranty
- Installation Guide
- Specification
- Use and Care Manual

Feedback

Your ideas make us better!

How was your shopping experien

Please let us know how we can improve better serve you.

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Specifications

Dimensions: H 5.5 in, W 29.875 in, D 20 in

Questions & Answers

114 Questions

Customer Reviews

22 cu. ft. Side-by-Side Refrigerator

WRS312SNH



Monochromatic Stainless Steel
WRS312SNHM

Also available in:

White	**WRS312SNHW**
Black	**WRS312SNHB**

Capacity

Total Capacity	22 cu. ft.
Refrigerator Capacity	15 cu. ft.
Freezer Capacity	7 cu. ft.

General Features & Properties

Electronic Temperature Controls
Optional Icemaker
Frameless Glass Shelves
Adaptive Defrost
Humidity-Controlled Crispers
#1 Selling Appliance Brand in the U.S.A.*

Electrical Details

Amps	7.2
Volts	110

Technical Details

Refrigerator Type	Side-by-Side
Number of Doors	2
Number of Interior Refrigerator Shelves	4
Number of Refrigerator Door Bins	2 Fixed, 3 Adjustable
Number of Interior Freezer Shelves	4
Number of Freezer Door Bins	4 Fixed
Lighting Type	LED
Ice Maker	Optional
Ice Maker Location	Freezer
Dispenser Type	No Dispenser

Dimensions

Product Dimensions (H x W x D)	66-5/8" x 32-3/4" x 33-5/8"
Depth with Door Open 90°	49-5/16"
Cutout Dimensions	Allow extra 1/2" on sides and top Allow extra 1" on rear

Reference Material

Dimension Guide

Install Guide

Energy Guide

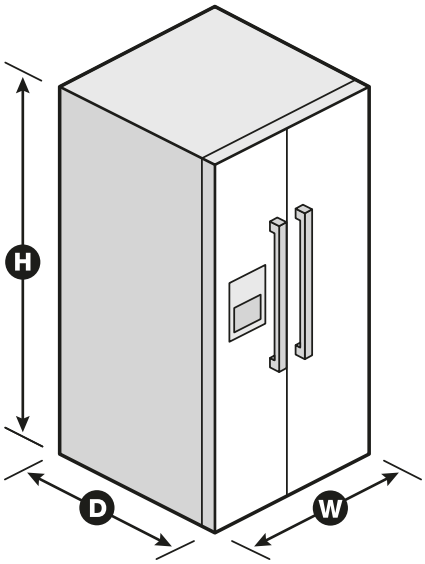
Warranty

Key Features & Benefits

Adjustable Gallon Door Bins
Move these adjustable bins anywhere in the door for increased loading flexibility when and where you need it.

LED Interior Lighting
Keep food looking as good as it tastes. Light is cast inside the refrigerator so food looks like it's supposed to.

Hidden Hinges
Get a seamless look with door hinges that stay out of sight.



*Based on 12-month average of unit sales. Refrigeration, Cooking, Dishwashers and Laundry appliances. TraQline 2018. NOTE: Dimensions are for planning purposes only. For complete details, see Installation Instructions packed with product. Specifications subject to change without notice.

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#1 Home Improvement Retailer

Pleasant Ridge 10PM 45213 Wh Pleasant Ridge 10PM 45213 Shop All Services DIY Log In

Home / Appliances / Dishwashers / Built-In Dishwashers

Internet # 320472170 Model # GDF460PSTSS Store SKU # 1008493078 Store SO SKU #1007735

GE

24 in. Built-In Tall Tub Front Control Stainless Steel Dishwasher with 60 dBA, ENERGY STAR

(1340) Questions & Answers (206)











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Share Print

Feedback

Undercounter Dishwasher

PRODUCT MODEL NUMBERS

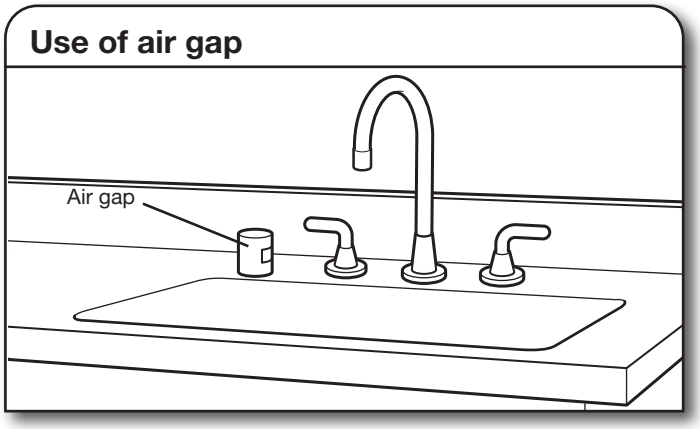
WDT550SAPW **WDT550SAPZ** **WDT550SAPB**

DRAIN REQUIREMENTS

- A new drain hose is supplied with your dishwasher. If drain hose is not long enough, use a drain hose extension with a maximum length of 12 ft (3.7 m).
- Make sure to connect drain hose to waste tee or disposer inlet above drain trap in house plumbing and 20" (508 mm) minimum above the floor. It is recommended that the drain hose either be looped up and securely fastened to the underside of the counter or be connected to an air gap.

IMPORTANT: This product is not equipped with a high loop on the side of the dishwasher. The installer is responsible for adding a high loop in the adjacent cabinet. A high loop is required if the dishwasher will drain into a floor drain. This prevents water draw off from the dishwasher during operation. When the drain is connected to a sink drain, counter-top air-gap or disposer, the high loop is generally not required. An check valve internal to the drain prevents back-flow into the dishwasher.

- Make sure to use an air gap if the drain hose is connected to house plumbing lower than 20" (508 mm) above subfloor or floor.



- If required, the air gap should be installed in accordance with the air gap installation instructions. When you are connecting the air gap, a rubber hose (not provided) will be needed to connect to the waste tee or disposer inlet.
- Use 1/2" (13 mm) minimum I.D. drain line fittings.

WATER SUPPLY REQUIREMENTS

- This dishwasher maybe fitted with a smart inlet hose with a water cut off valve. Do not cut the water inlet hose for any reason, to install, adapt or shorten.
- This dishwasher has a water heating feature and also requires a connection to a hot water supply line.
- A hot water line with 20 psi to 120 psi (138 kPa to 862 kPa) water pressure can be verified by a licensed plumber.
- 120°F (49°C) water at dishwasher.
- 3/8" (95 mm) O.D. copper tubing with compression fitting or flexible braided water supply line.
- Included water inlet hose with Leak Detection System for some models.
- Included 3/8" (9.5 mm) Compression x 3/4" (19 mm) Water inlet adapter (only for models with Leak Detection System).
- If installed in new construction, make sure the house water supply lines have been flushed prior to connecting the dishwasher to remove any debris that may exist in the supply line.

ELECTRICAL REQUIREMENTS

Be sure that the electrical connection and wire size are adequate and in conformance with the National Electrical Code, ANSI/NFPA 70 - latest edition, and all local codes and ordinances.

For a fee, a copy of the above code standards can be obtained from:

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

You Must Have:

- 120 V, 60 Hz, AC only, 15 A or 20 A, fused electrical supply.
- Copper wire only.
- A maximum of 2 field wiring supply conductors (12 AWG largest size) plus 1 grounding conductor are permitted in the terminal box.

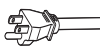
We Recommend:

- Install the dishwasher on a circuit with appropriate interrupte per your local code. The dishwasher is compatible with tim delay fuses, standard circuit breakers, and GFCI and AFCI circuit breakers.

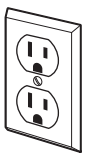
Circuit Requirement:

- The dishwasher may be installed on the same circuit as a garbage disposal providing that the branch circuit cannot exceed rated circuit load and must comply with all governing codes and regulations such as but not limited to National Electrical Code, ANSI/NFPA 70 - latest edition.
- No electrical connections other than the dishwasher power and ground connections can be made inside of the dishwasher junction box.

If Connecting Dishwasher with a Power Cord:



- Use UL Listed power cord kit marked for use with dishwasher. See the “Tools and Parts” section at the front of the Owner’s manual for part details and orders.



- Plug into a grounded 3 prong outlet. Outlet must meet all local codes and ordinances.

If Connecting Dishwasher with Direct Wiring:



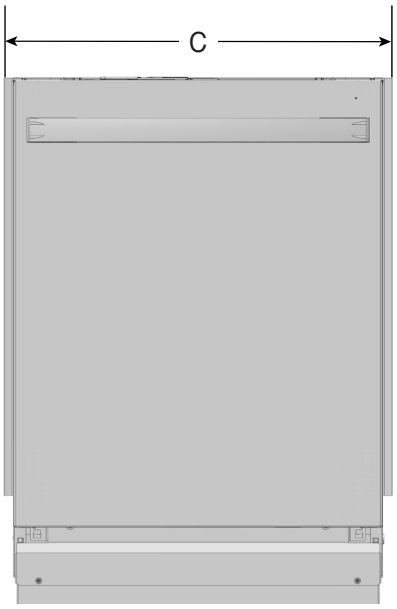
- Use flexible, armored, or nonmetallic sheathed copper wire with grounding wire that meets the wiring requirements for your home and local codes and ordinances.
- Use only the supplied plastic cable fittings for flexible and non-metallic sheathed wiring (Romex, etc.). Do not use metallic strain reliefs for these wire constructions.
- Use a UL-listed/CSA-approved metallic strain relief for armored cable installations (21 mm diameter), Using the strain relief’s manufacturer installations instructions.

Because Whirlpool Corporation policy includes a continuous commitment to improve our products, we reserve the right to change materials and specifications without notice.

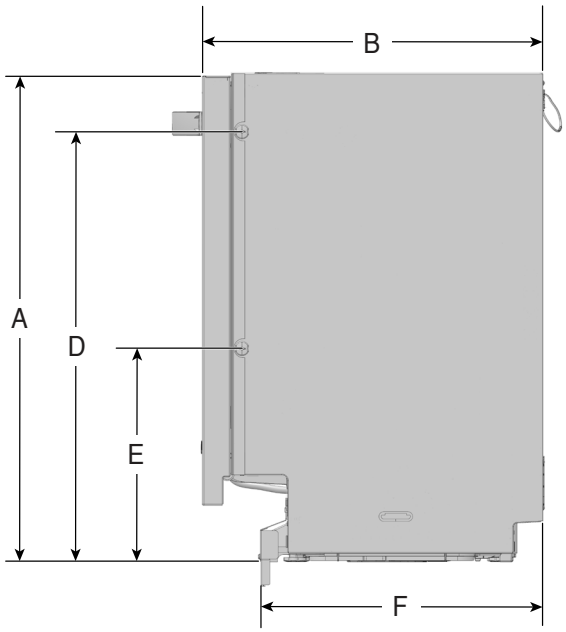
Dimensions are for planning purposes only. For complete details, see Installation Instructions packed with product. Specifications subject to change without notice.

W11562389A

PRODUCT DIMENSIONS

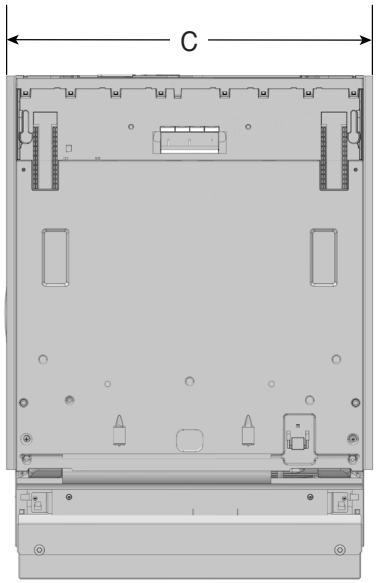


C. 23 9/16" (599 mm)

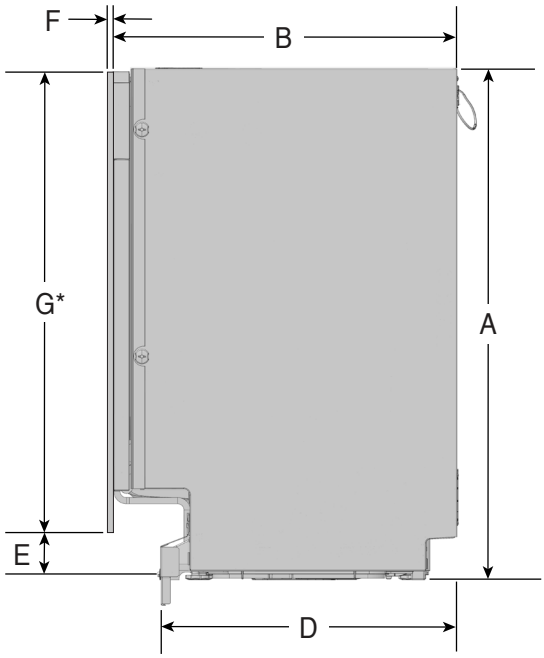


A. 32 1/4"-35 7/16" (820-900 mm)
B. 22 5/8" (574 mm)
D. 28 3/8" (721 mm)
E. 14 1/16" (358 mm)
F. 18 3/4" (477 mm)

PRODUCT DIMENSIONS (FOR PANEL READY MODELS)



C. 23 9/16" (599 mm)



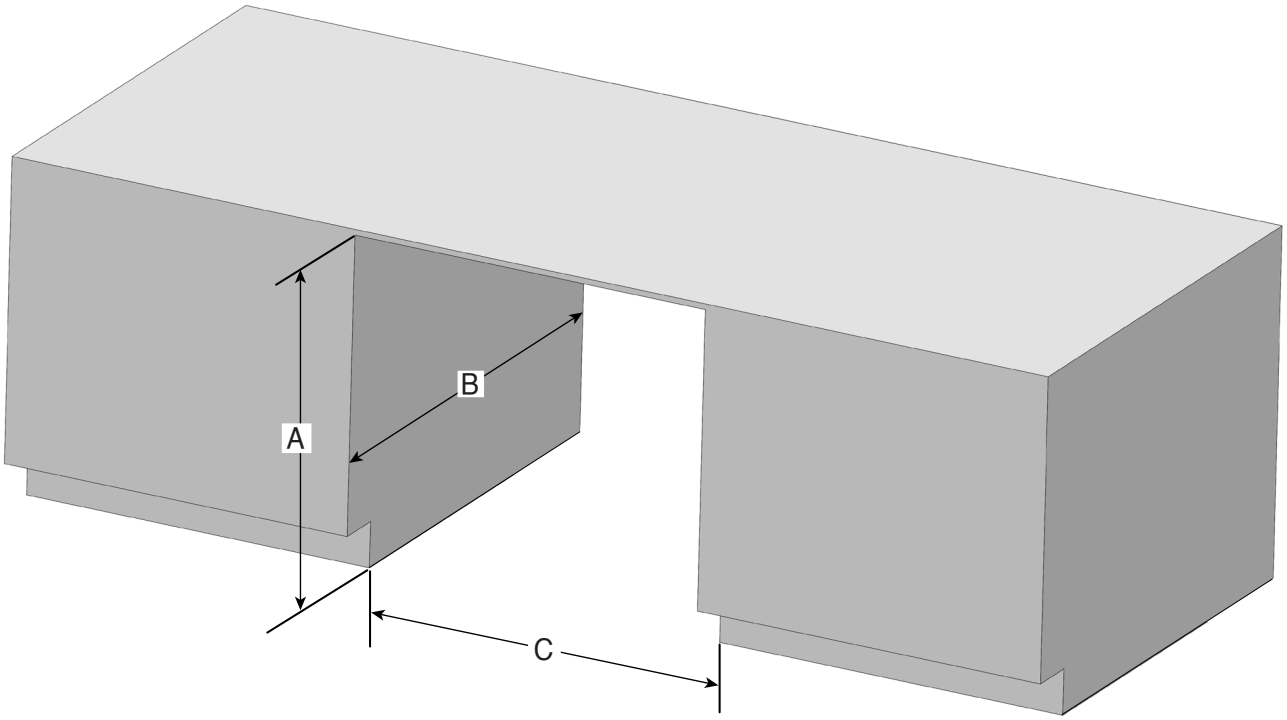
A. 32 1/4"-35 7/16" (820-900 mm)
B. 21 7/8" (555 mm)
D. 18 3/4" (477 mm)
E. E = A - G
F. 11/16"-1 3/4" (18-45 mm)
G. 28 3/8"-29 15/16" (720-760 mm)

***NOTE:** If a custom toe kick is desired to be installed, adjust the thickness of the custom panel to make it flush with the cabinet toe kick. Product's original metal toe kick must remain even if custom toe kick is installed.

Because Whirlpool Corporation policy includes a continuous commitment to improve our products, we reserve the right to change materials and specifications without notice.

Dimensions are for planning purposes only. For complete details, see Installation Instructions packed with product. Specifications subject to change without notice.

CABINET OPENING DIMENSIONS



A. 32 1/4"-35 7/16" (820-900 mm) measured from the lowest point on the underside of the countertop.
B. 24" (609.6 mm) Minimum
C. 23 5/8"-24 1/4" (600-616 mm) Minimum, measured from narrowest point of opening.

Because Whirlpool Corporation policy includes a continuous commitment to improve our products, we reserve the right to change materials and specifications without notice.

Dimensions are for planning purposes only. For complete details, see Installation Instructions packed with product. Specifications subject to change without notice.

Lave-vaisselle sous comptoir

NUMÉROS DE MODÈLE DU PRODUIT

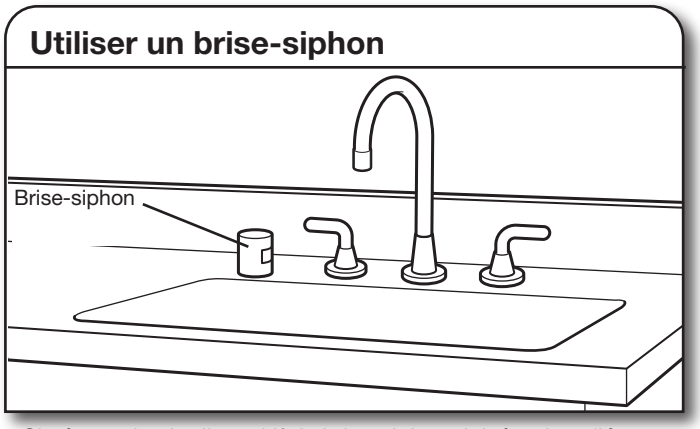
WDT550SAPW **WDT550SAPZ** **WDT550SAPB**

EXIGENCES D'ÉVACUATION

- Un tuyau d'évacuation neuf est fourni avec le lave-vaisselle. Si le tuyau de vidange n'est pas assez long, utiliser une rallonge de tuyau de vidange d'une longueur maximale de 12 pi (3,7 m).
- Veiller à raccorder le tuyau d'évacuation à la canalisation d'égout en T ou au raccord de broyeur à déchets en amont du siphon du circuit de plomberie du domicile, et à au moins 20 po (508 mm) au-dessus du sol. On recommande de lover le tuyau d'évacuation et de le fixer solidement sur la face inférieure du comptoir ou de le raccorder à un dispositif de brise-siphon.

IMPORTANT : Ce produit n'est pas équipé d'une boucle surélevée sur le côté du lave-vaisselle. L'installateur est responsable de l'ajout d'une boucle surélevée dans l'armoire adjacente. Une boucle surélevée est nécessaire si le lave-vaisselle s'écoule dans un drain de plancher. Cela permet d'éviter que l'eau ne s'écoule du lave-vaisselle pendant son fonctionnement. Lorsque le drain est raccordé à un drain d'évier, à un dispositif brise-siphon de comptoir ou à un broyeur, la boucle surélevée n'est généralement pas nécessaire. Un clapet anti-retour interne au drain empêche le reflux dans le lave-vaisselle.

- Utiliser un dispositif de brise-siphon si le tuyau d'évacuation est raccordé au circuit de plomberie du domicile à moins de 20 po (508 mm) au-dessus du sous-plancher ou du plancher.



- Si nécessaire, le dispositif de brise-siphon doit être installé conformément aux instructions d'installation de ce dernier. Lors du raccordement du dispositif de brise-siphon à la canalisation d'égout en T ou au raccord de broyeur à déchets, un tuyau en caoutchouc (non fourni) sera nécessaire.
- Utiliser des raccords de canalisation d'évacuation de diamètre intérieur de 1/2 po (13 mm) minimum.

SPÉCIFICATIONS DE L'ALIMENTATION EN EAU

- Ce lave-vaisselle peut être équipé d'un tuyau d'arrivée intelligent avec une vanne de coupure d'eau. Ne pas couper le tuyau d'arrivée d'eau pour quelque raison que ce soit, pour l'installer, l'adapter ou le raccourcir.
- Ce lave-vaisselle est doté d'une fonction de chauffage de l'eau et doit être raccordé à la canalisation d'alimentation en eau chaude.
- Une canalisation d'eau chaude, sous pression de 20 à 120 lb/po^2 (138 à 862 kPa), peut être inspectée par un plombier certifié.
- Température de 120 °F (49 °C) à l'entrée du lave-vaisselle.
- Tube de cuivre de 3/8 po (9,5 mm) de diamètre externe avec raccord de compression ou canalisation d'alimentation en eau flexible à tresse d'acier.
- Tuyau d'arrivée d'eau inclus avec le Système de Détection des Fuites pour certains modèles.
- Adaptateur de compression de 3/8 po (9,5 mm) x 3/4 po (19 mm) inclus pour l'arrivée d'eau (uniquement pour les modèles avec Système de Détection des Fuites).
- S'il est installé dans une nouvelle construction, vous assurer que l'entrée d'eau de la maison a été nettoyée avant d'effectuer le branchement au lave-vaisselle pour en enlever les débris possibles.

SPÉCIFICATIONS ÉLECTRIQUES

S'assurer que le raccordement électrique est adéquat et conforme au Code National de l'Électricité, ANSI/NFPA 70 – dernière édition, et à tous les codes et règlements locaux en vigueur.
Pour obtenir un exemplaire gratuit des normes des codes ci-dessus, contacter :

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

Il vous faut :

- Alimentation de 120 V CA à 60 Hz et protégée par un fusible de 15 ou 20 A.
- Conducteurs de cuivre uniquement.
- Un maximum de deux conducteurs d'alimentation (calibre 12 AWG maximum) plus un conducteur de mise à la terre est autorisé dans le boîtier de connexion.

Nous recommandons :

- Installer le lave-vaisselle sur un circuit doté d'un interrupteur approprié, conformément au code local. Le lave-vaisselle est compatible avec les fusibles temporisés, les disjoncteurs standard et les disjoncteurs différentiels (GFCI) et disjoncteurs d'arc électrique (AFCI).

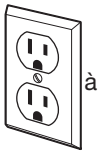
Spécifications du Circuit :

- Le lave-vaisselle peut être installé sur le même circuit que le broyeur à déchets en s'assurant que ce circuit ne dépasse pas la charge nominale et qu'il respecte les normes et codes dont, mais ne se limitant pas, au Code National de l'Électricité, ANSI/NFPA 70 – dernière édition.
- Aucun autre raccordement électrique que ceux des conducteurs d'alimentation et de mise à la terre du lave-vaisselle ne peuvent être effectués à l'intérieur du boîtier de raccordement électrique du lave-vaisselle.

Pour le Raccordement du Lave-vaisselle avec un Cordon d'Alimentation Électrique :



- Utiliser un cordon d'alimentation (homologation UL) conçu pour utilisation avec un lave-vaisselle. Voir la section « Outils et Pièces » sur la couverture du manuel de l'Utilisateur pour des détails sur les pièces et pour commander.



- Brancher l'appareil sur une prise à 3 alvéoles reliée à la terre. La prise doit être conforme tous les codes et règlements locaux.

Pour le Raccordement Direct du Lave-vaisselle :

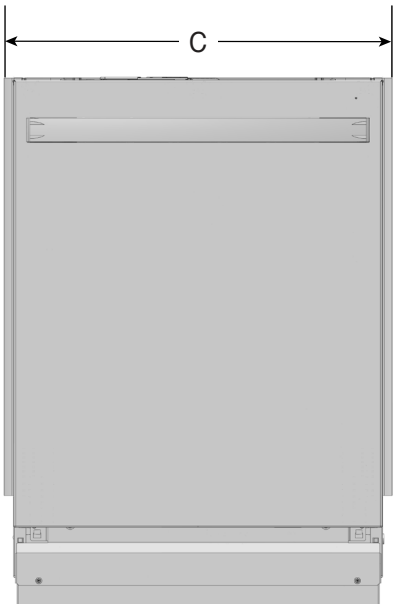


- Utiliser des conducteurs de cuivre gainés non métalliques ou blindés souples avec conducteur de liaison à la terre qui satisfassent aux exigences de l'installation électrique du domicile, et qui soient conformes aux prescriptions des codes et règlements locaux.
- Utiliser seulement les raccords de câble en plastique fournis pour les câbles flexibles et les câbles à gaine non métallique (Romex, etc.). Ne pas utiliser de serre-câbles métalliques pour ces constructions de fils.
- Utiliser un serre-câbles métallique homologuée UL/CSA pour les installations de câbles armés (21 mm de diamètre). Respecter les instructions d'installation du serre-câbles.

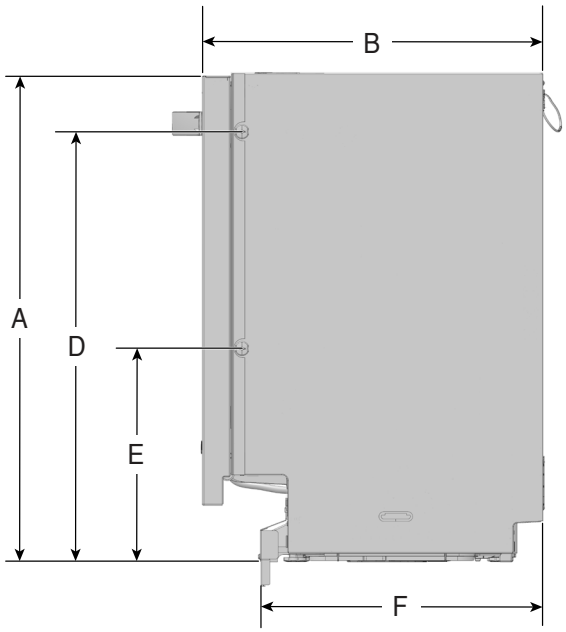
La politique de Whirlpool Corporation, c'est aussi notre engagement à travailler sans relâche à l'amélioration de nos produits; aussi nous nous réservons le droit de modifier les matériaux et spécifications sans préavis.

Les dimensions sont indiquées à des fins de planification uniquement. Pour des détails complets, voir les Instructions d'Installation fournies avec le produit. Spécifications indiquées sous réserve de modifications.

DIMENSIONS DU PRODUIT

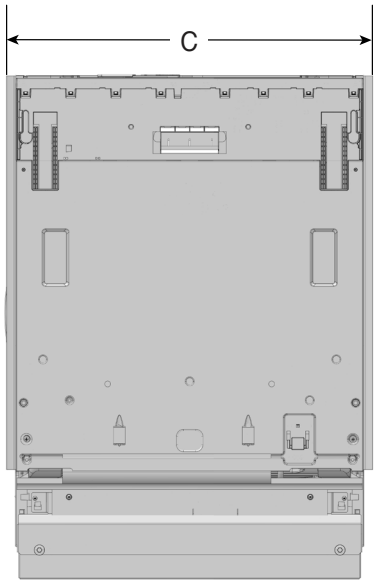


C. 23 9/16 po (599 mm)

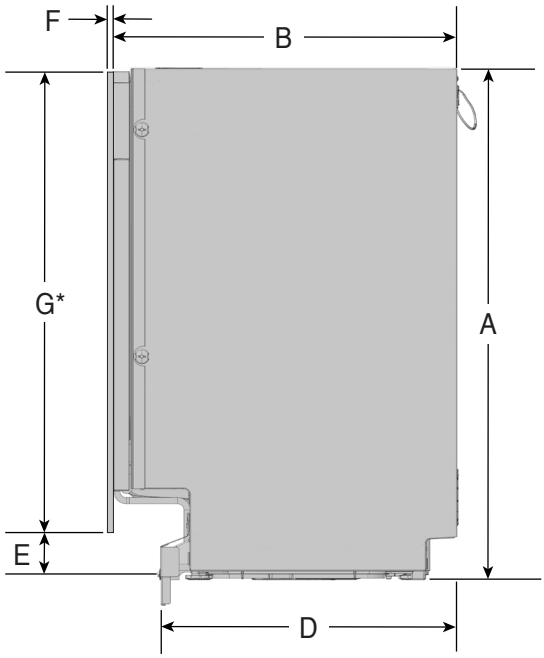


A. 32 1/4 po-35 7/16 po (820-900 mm)
B. 22 5/8 po (574 mm)
D. 28 3/8 po (721 mm)
E. 14 1/16 po (358 mm)
F. 18 3/4 po (477 mm)

DIMENSIONS DU PRODUIT (POUR LES MODÈLES AVEC PANNEAU PRÊT-À-INSTALLER)



C. 23 9/16 po (599 mm)



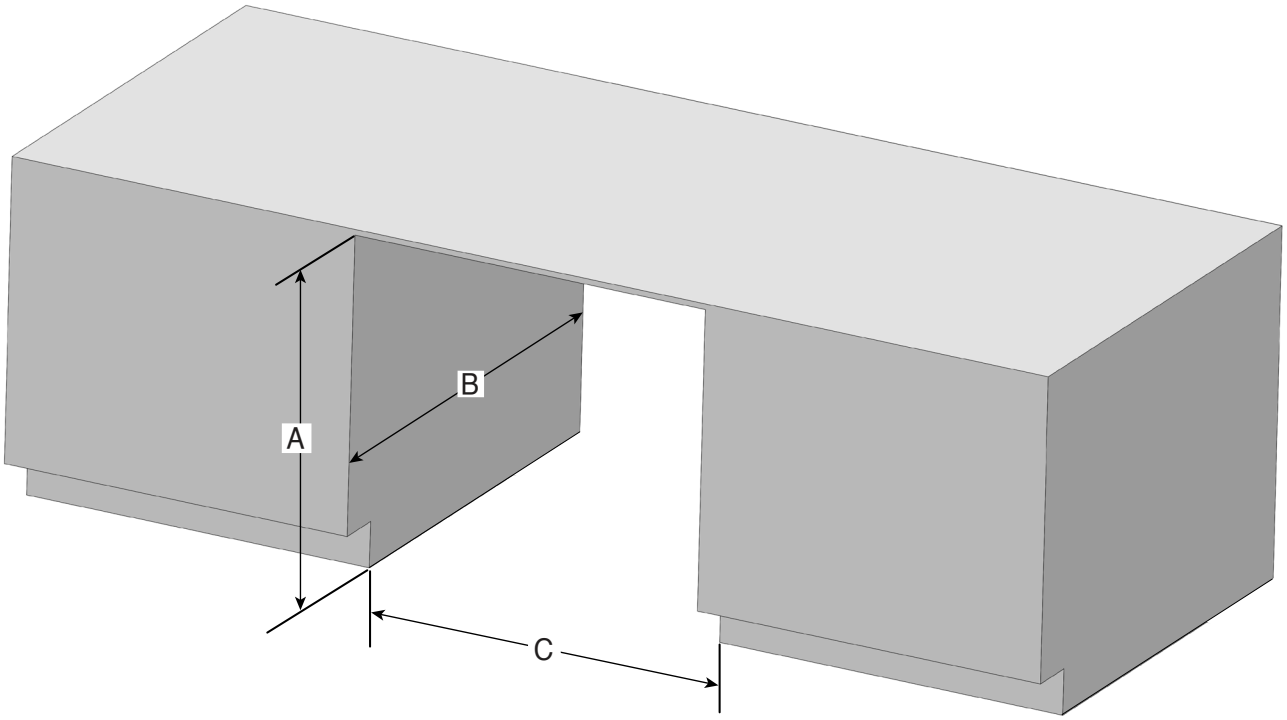
A. 32 1/4 po-35 7/16 po (820-900 mm)
B. 21 7/8 po (555 mm)
D. 18 3/4 po (477 mm)
E. E = A - G
F. 11/16 po-1 3/4 po (18-45 mm)
G. 28 3/8 po-29 15/16 po (720-760 mm)

***REMARQUE :** Pour installer une plinthe personnalisée, ajuster l'épaisseur du panneau personnalisé pour qu'il soit au même niveau que la plinthe du meuble.w La plinthe métallique d'origine du produit doit rester en place même si une plinthe personnalisée est installée.

La politique de Whirlpool Corporation, c'est aussi notre engagement à travailler sans relâche à l'amélioration de nos produits; aussi nous nous réservons le droit de modifier les matériaux et spécifications sans préavis.

Les dimensions sont indiquées à des fins de planification uniquement. Pour des détails complets, voir les Instructions d'Installation fournies avec le produit. Spécifications indiquées sous réserve de modifications.

DIMENSIONS DE L'OUVERTURE DE L'ARMOIRE



A. 32 1/4 po à 35 7/16 po (820 à 900 mm) depuis le point le plus bas de la face inférieure du plan de travail.
B. Minimum de 24 po (609,6 mm)
C. 23 5/8 po-24 1/4 po (600-616 mm) Minimum mesuré au point le plus étroit de l'ouverture.

La politique de Whirlpool Corporation, c'est aussi notre engagement à travailler sans relâche à l'amélioration de nos produits; aussi nous nous réservons le droit de modifier les matériaux et spécifications sans préavis.

Les dimensions sont indiquées à des fins de planification uniquement. Pour des détails complets, voir les Instructions d'Installation fournies avec le produit. Spécifications indiquées sous réserve de modifications.

Lavavajillas para instalarse debajo del mostrador

NÚMEROS DE MODELOS DE PRODUCTOS

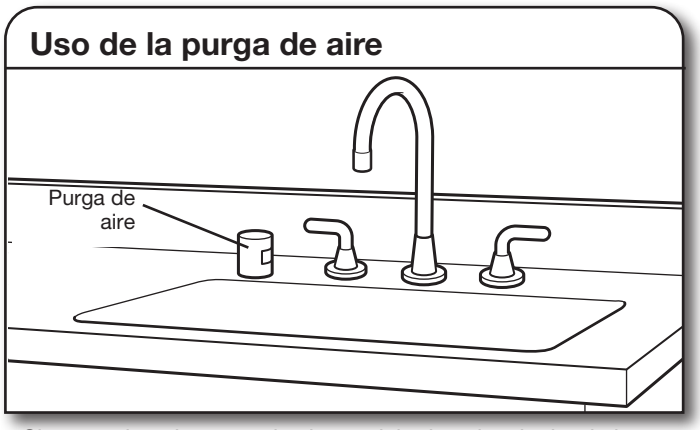
WDT550SAPW WDT550SAPZ WDT550SAPB

REQUISITOS DE DESAGÜE

- Se provee una manguera nueva de desagüe con su lavavajillas. Si la manguera de desagüe no es lo suficientemente larga, utilice una extensión de manguera de desagüe con una longitud máxima de 12 pies (3,7 m).
- Asegúrese de conectar la manguera de desagüe al conector de residuos en "T" o a la entrada del colector de residuos sobre el sifón de desagüe en la plomería de la casa, y a un mínimo de 20" (508 mm) por encima del piso. Se recomienda que la manguera de desagüe se enrolle y fije con firmeza a la parte inferior del mostrador o que se conecte a una purga de aire.

IMPORTANTE: Este producto no está equipado con un circuito alto en el lateral del lavavajillas. El instalador es responsable de añadir un circuito alto en el gabinete adyacente. Se requiere un circuito alto si el lavavajillas va a vaciar en un desagüe de piso. De este modo se evita la salida de agua del lavavajillas durante el funcionamiento. Cuando el desagüe está conectado a un desagüe de fregadero, a una cámara de aire de mostrador o a un triturador de basura, el circuito alto no suele ser necesario. Una válvula de retención interna al desagüe impide el reflujo hacia el lavavajillas.

- Asegúrese de utilizar una purga de aire si la manguera de desagüe está conectada a la plomería de la casa a una altura menor de 20" (508 mm) sobre el contrapiso o el piso.



- Si se requiere, la purga de aire se debe instalar siguiendo las instrucciones de instalación de la misma. Al conectar la purga de aire, se requiere una manguera de goma (no proporcionada) para conectarla al tubo de residuos en "T" o la entrada del colector de residuos.
- Use accesorios para líneas de desagüe con un diámetro interior de 1/2" (13 mm) mínimo.

REQUISITOS DE SUMINISTRO DE AGUA

- Este lavavajillas puede estar equipado con una manguera de entrada inteligente con válvula de corte de agua. No corte la manguera de entrada de agua por ningún motivo, ni para instalarla, adaptarla o acortarla.
- Este lavavajillas tiene una función de calentamiento de agua y también requiere una conexión a una tubería de suministro de agua caliente.
- Una tubería de agua caliente con presión de agua de 20 psi a 120 psi (de 138 kPa a 862 kPa), que pueda ser verificada por un plomero autorizado.
- Agua a 120 °F (49 °C) en el lavavajillas.
- Tubería de cobre con un diámetro externo de 3/8" (9,5 mm) con racor con conexión de compresión o tubería de suministro de agua trenzada flexible.
- Manguera de entrada de agua incluida con Sistema de Detección de Fugas para algunos modelos.
- Incluye el adaptador de entrada de agua de 3/8" (9,5 mm) con compresión x 3/4" (19 mm) (solo para modelos con Sistema de Detección de Fugas).
- Si la instalación se realiza en una construcción nueva, asegúrese de enjuagar las tuberías de suministro de agua domésticas antes de conectar la lavavajillas para eliminar cualquier residuo presente en la tubería de suministro.

REQUISITOS ELÉCTRICOS

Asegúrese de que la conexión eléctrica y el tamaño del cable sean adecuados y cumplan con el Código Nacional Eléctrico, ANSI/NFPA 70, su edición más reciente, y con todos los códigos y las ordenanzas locales.

Puede obtener una copia sin costo de los códigos antes indicados en:

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

Usted debe tener:

- Un suministro eléctrico de 120 V, 60 Hz., CA solamente, con fusibles de 15 A o 20 A.
- Solo cable de cobre.
- Se permite un máximo de 2 conductores de suministro de cable en sitio (tamaño máximo: 12 AWG) y 1 conductor de conexión a tierra en la caja de terminales.

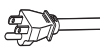
Se recomienda:

- Instale el lavavajillas en un circuito con interrupción adecuada según su código local. El lavavajillas es compatible con fusibles temporizados, disyuntores estándar y disyuntores GFCI y AFCI.

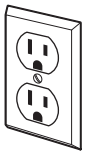
Requisitos del Circuito:

- El lavavajillas se puede instalar en el mismo circuito que el triturador de basura siempre y cuando el circuito derivado no exceda la carga calculada del circuito y cumpla con todos los códigos y regulaciones vigentes, como, por ejemplo, la edición más reciente del Código Nacional Eléctrico, ANSI/NFPA 70.
- No se puede realizar ninguna otra conexión eléctrica dentro de la caja de conexiones del lavavajillas más que la conexión a tierra y la de suministro eléctrico de este.

Conexión del Lavavajillas con un Cable de Alimentación:



- Use un cable de suministro de energía con certificación UL para uso con lavavajillas. Consulte la sección "Herramientas y Piezas" al principio del manual del Propietario para los detalles y el pedido de piezas.



- Conecte a un tomacorriente con conexión a tierra de 3 terminales. El tomacorriente debe cumplir con todos los códigos y ordenanzas locales.

Conexión del Lavavajillas con Cableado Directo:

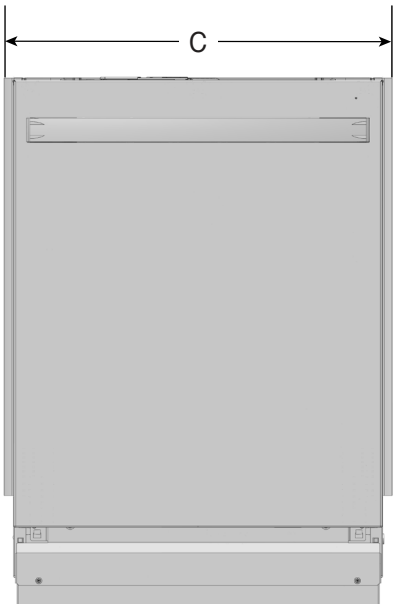


- Utilice un cable de cobre flexible, blindado o con una funda no metálica con un cable de conexión a tierra que cumpla con los requisitos de cableado para su hogar y con los códigos y ordenanzas locales.
- Use solamente los racores de plástico suministrados para el cableado flexible y no metálico (Romex, etc.). No use alivios de tensión metálicos para estas construcciones de cables.
- Use un alivio de tensión metálico homologado por UL/CSA para las instalaciones de cables armados (21 mm de diámetro), siguiendo las instrucciones de instalación del fabricante del alivio de tensión.

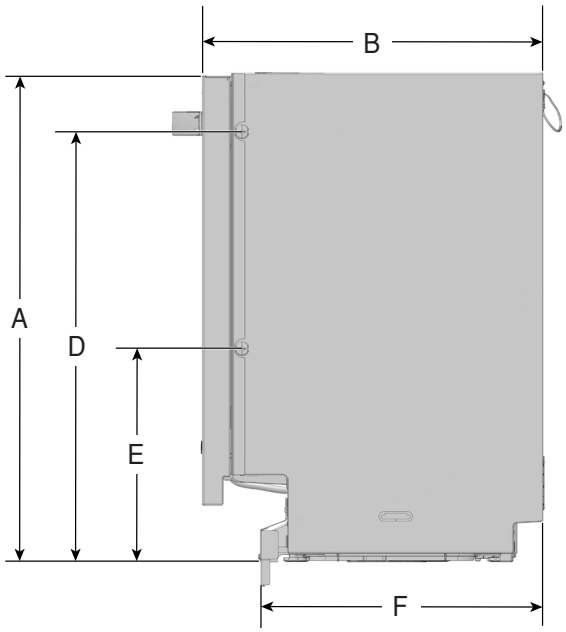
Debido a que la política de Whirlpool Corporation incluye un compromiso continuo para mejorar sus productos, se reserva el derecho de cambiar los materiales y las especificaciones sin previo aviso.

Las dimensiones son solo para fines de planificación. Para obtener los detalles completos, vea las Instrucciones de Instalación incluidas con el producto. Las especificaciones están sujetas a cambio sin previo aviso.

DIMENSIONES DEL PRODUCTO

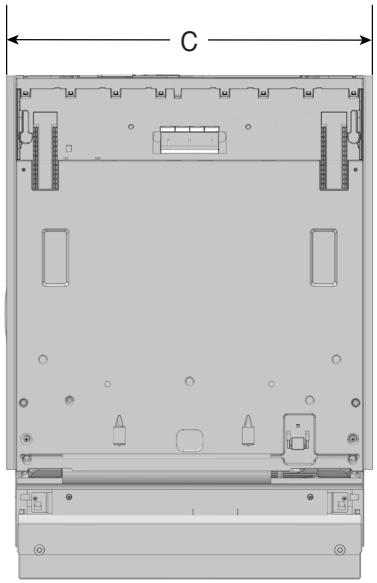


C. 23$^{9}/_{16}$" (599 mm)

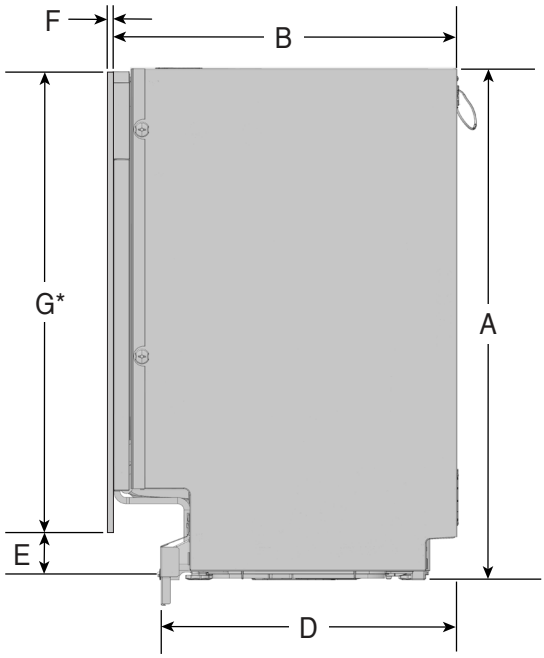


A. 32$^{1}/_{4}$"-35$^{7}/_{16}$" (820-900 mm)
B. 22$^{5}/_{8}$" (574 mm)
D. 28$^{3}/_{8}$" (721 mm)
E. 14$^{1}/_{16}$" (358 mm)
F. 18$^{3}/_{4}$" (477 mm)

DIMENSIONES DEL PRODUCTO (PARA MODELOS LISTOS PARA PANEL)



C. 23$^{9}/_{16}$" (599 mm)



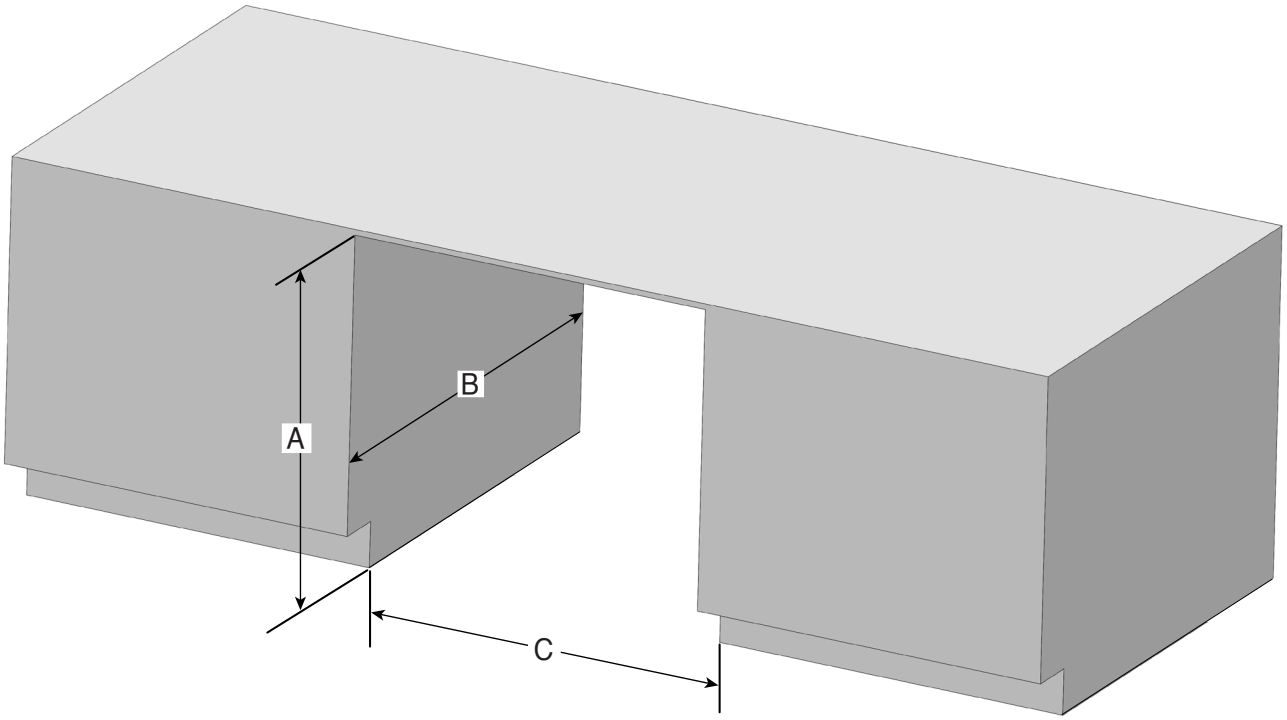
A. 32$^{1}/_{4}$"-35$^{7}/_{16}$" (820-900 mm)
B. 21$^{7}/_{8}$" (555 mm)
D. 18$^{3}/_{4}$" (477 mm)
E. E = A - G
F. 11/16"-1$^{3}/_{4}$" (18-45 mm)
G.28$^{3}/_{8}$"-29$^{15}/_{16}$" (720-760 mm)

***NOTA:** Si se desea instalar un zócalo a medida, ajuste el grosor del panel a medida para que quede enrasado con el zócalo del gabinete. El zócalo metálico original del producto debe permanecer aunque se instale un zócalo personalizado.

Debido a que la política de Whirlpool Corporation incluye un compromiso continuo para mejorar sus productos, se reserva el derecho de cambiar los materiales y las especificaciones sin previo aviso.

Las dimensiones son solo para fines de planificación. Para obtener los detalles completos, vea las Instrucciones de Instalación incluidas con el producto. Las especificaciones están sujetas a cambio sin previo aviso.

DIMENSIONES DE LA ABERTURA DEL GABINETE



A. 32 1/4"-35 7/16" (820-900 mm) medido desde el punto más bajo de la parte inferior del mostrador.
B. 24" (609,6 mm) Mínimo
C. 23 5/8"-24 1/4" (600-616 mm) Mínimo, medido desde el punto más estrecho de la abertura.

Debido a que la política de Whirlpool Corporation incluye un compromiso continuo para mejorar sus productos, se reserva el derecho de cambiar los materiales y las especificaciones sin previo aviso.

Las dimensiones son solo para fines de planificación. Para obtener los detalles completos, vea las Instrucciones de Instalación incluidas con el producto. Las especificaciones están sujetas a cambio sin previo aviso.

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Top Rated

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DOCUMENT 000115 - LIST OF DRAWING SHEETS

PART 1 - GENERAL

1.1 LIST OF DRAWINGS

A. Drawings: Drawings that will be enumerated in the Owner/Contractor Agreement as part of the Contract Documents are listed on the Table of Contents page of the separately bound drawing set titled <**Insert drawing set title**>, dated <**Insert date**>, as modified by subsequent Addenda and Modifications.

1. The words "Resource Drawing" or "For information" after the titles of drawings indicate that those drawings are not intended to be incorporated in the Contract Documents.

B. List of Drawings: Drawings that will be enumerated in the Owner/Contractor Agreement as part of the Contract Documents are the following Drawings and other drawings of type indicated, as modified by subsequent Addenda and Modifications:

1. <**Insert, in separate subparagraphs, drawing numbers and titles. Include the words "Resource Drawing" or "For information" after the titles of drawings that are not intended to be incorporated in the Contract Documents.**>

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 000115

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DOCUMENT 001116 - INVITATION TO BID

PART 1 - GENERAL

1.1 PROJECT INFORMATION

A. Notice to Bidders: [**Prequalified**][**Selected**] Bidders are invited to submit Bids for Project as described in this Document in accordance with the Instructions to Bidders.

B. Project Identification: <**Insert Project identifier such as Project name and number**>.

1. Project Location: <**Insert Project location (street address, city, and state)**>.

C. Owner: <**Insert name and address of Owner**>.

1. Owner's Representative: <**Insert name and contact information for Owner's representative**>.

D. Architect: <**Insert name and contact information for Architect**>.

E. Construction Manager: <**Insert name and contact information for Construction Manager**>.

F. Design-Builder: <**Insert name and contact information for Design-Builder**>.

G. Project Description: Project consists of <**Insert brief description of Project scope**>.

H. Construction Contract: Bids will be received for the following Work:

1. General Contract (all trades).
2. Multiple Contract Project consisting of the following prime contracts:

a. General Building Construction.
b. Plumbing Construction.
c. Mechanical Construction.
d. Electrical Construction.
e. <**Insert name of prime contract**>.

1.2 BID SUBMITTAL AND OPENING

A. Bid Submittal, Printed: Owner will receive sealed Bids until the bid time and date at the location indicated below. Owner will consider Bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

1. Bid Date: <**Insert date**>.
2. Bid Time: [**2:00 p.m.**]<**Insert time**>, local time.
3. Location: <**Insert bid receipt's location and room name**>, <**Insert street address**>,

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<Insert city, state, and zip code>.

4. Bids will be thereafter [privately opened][opened in the presence of the Bidders and read aloud].

B. Bid Submittal, Electronic: Owner will receive electronically submitted Bids until the bid time and date via web-based bidding management software. Owner will consider Bids prepared in compliance with the Instructions to Bidders and delivered as follows:

1. Bid Date: <Insert date>.
2. Bid Time: Not later than [2:00 p.m.]<Insert time>, local time.
3. Web-Based Bidding Management Software: <Insert URL and instructions>.
4. Bids will be thereafter opened and [read aloud to Bidders via private webcast and teleconference as indicated in the Instructions to Bidders][privately opened].

1.3 BID SECURITY

A. Submit bid security with each Bid in the stipulated form and in the amount identified in the Instructions to Bidders.

B. Bid security shall be submitted with each bid in the amount of [5]<Insert number> percent of the bid amount. No bids may be withdrawn for a period of [60]<Insert number> days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.4 PREBID MEETINGS

A. Prebid Meeting: See Document 002513 "Prebid Meetings."

B. Prebid Meeting, In Person: A prebid meeting for all Bidders will be held at <Insert location> on <Insert date> at [10:00 a.m.]<Insert time>, local time. Prospective prime Bidders are [requested][required] to attend.

C. Prebid Meeting, Web Based: A prebid meeting for all Bidders will be held on <Insert date> at [10:00 a.m.]<Insert time>, local time. Prospective prime Bidders are [requested][required] to attend. Register for Prebid meeting as follows: <Insert registration instructions>.

D. Bidders' Questions: Architect will provide responses at Prebid conference to Bidders' questions received up to [two]<Insert number> business days prior to conference. Submit requests for clarification and interpretation using method indicated in Instructions to Bidders.

E. Site Walkthrough Meeting: A site walkthrough meeting for all Bidders will be held at Project location on <Insert date> at [10:00 a.m.]<Insert time>, local time. Prospective prime Bidders are [requested][required] to attend. Register for Site Walkthrough Meeting as follows: <Insert registration instructions>.

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1.5 BIDDING DOCUMENTS

A. Bidding Documents, Printed: Obtain after <**Insert date**> by contacting <**Insert Owner, Architect, or reprographic house address**>. [**Documents will be provided to prime Bidders only.**] Only complete sets of documents will be issued.

1. Deposit: [**$100.00**]<**Insert amount**>.
2. Shipping: Additional shipping charges of <**Insert amount**> will apply.

B. Bidding Documents, Electronic: Obtain access after <**Insert date**> by contacting <**Insert Owner, Architect, or reprographic house address**>. Online access will be provided to [**prime Bidders only**][**all registered Bidders and Sub-Bidders and suppliers**].

1.6 TIME OF COMPLETION

A. By submitting a Bid, Bidder represents that Bidder will begin the Work on receipt of the Notice to Proceed and will complete the Work within the Contract Time indicated in the Bidding Documents.

1.7 LIQUIDATED DAMAGES

A. Work is subject to liquidated damages.

1.8 BIDDER'S QUALIFICATIONS

A. Prequalification: Invited Bidders must have been prequalified by Owner prior to submission of Bids.

B. Licenses: Bidders must be properly licensed under the laws governing their respective trades.

C. Insurance and Bonds: A Performance Bond, separate Labor and Material Payment Bond, and insurance in a form acceptable to Owner will be required of the successful Bidder.

D. Contractor's Qualification Statement: A completed AIA Document A305, "Contractor's Qualification Statement," with all exhibits [**is required to be submitted with the bid**][**will be requested from one or more Bidders following receipt of Bids**].

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 001116

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DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 INSTRUCTIONS TO BIDDERS

A. AIA Document A701-2018, "Instructions to Bidders," is hereby incorporated into the Bidding Documents by reference.

1. A copy of AIA Document A701-2018, "Instructions to Bidders," [**with Project-specific edits**] is bound in this Project Manual.
2. Document 002213 "Supplementary Instructions to Bidders" is bound in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 002113

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DOCUMENT 002115 - INSTRUCTIONS FOR PREQUALIFICATION

PART 1 - GENERAL

1.1 PURPOSE, LAWS, AND REGULATIONS

A. The purpose of the Prequalification Procedure described in this Document is to provide Owner with a mechanism to evaluate and determine whether Prospective Bidders are qualified to participate in the construction of Project. Evaluation will be limited to that office of the Prospective Bidder that is proposed to perform the Work.

B. Applicable provisions of <**Insert titles of laws and regulations**> are to be observed in the soliciting, receiving, and evaluating of Prospective Bidders' qualifications.

C. Applicable provisions of <**Insert titles of laws and regulations**> are to be observed in bidding, letting, and execution of the Work.

D. Prospective Bidders are required to comply with these Requirements for Prequalification. Only those Prospective Bidders who have complied with the Requirements for Prequalification and have been determined to be qualified will be eligible to submit construction bids on Project.

1.2 DEFINITIONS

A. Financial Statement: The requirement for submitting a financial statement as an attachment to AIA Document A305, "Contractor's Qualification Statement," is understood to mean a certified annual audit, prepared according to generally acceptable accounting practices and signed by an independent certified public accountant.[**A Reviewed Statement of Assets and Liabilities, prepared and signed by an independent certified public accountant, is also acceptable.**] A self-prepared annual compiled financial statement or balance sheet is unacceptable.

B. Prospective Bidder: A Prospective Bidder is a person or entity who submits a Submittal of Qualifications to Owner.

C. Project: Generally described in the [**Advertisement for Prequalification of Bidders**][**Advertisement for Bids**].

1.3 PREQUALIFICATION DOCUMENTS

A. Prequalification Documents: Consist of Document 001115 "Advertisement for Prequalification of Bidders," this "Instructions for Prequalification" Document, AIA Document A304-2023, "Request for Contractor's Qualifications," and AIA Document A305-2020, "Contractor's Qualification Statement," with required exhibits and additional documents issued by Owner.

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B. Obtaining Prequalification Documents: Prospective Bidders may obtain complete sets of the Prequalification Documents from the issuing office designated in the Advertisement for Prequalification of Bidders. Prospective Bidders are to use complete sets of Prequalification Documents in preparing their submittal. Owner assumes no responsibility for errors or misinterpretations resulting from the use of incomplete sets of Prequalification Documents.

C. Interpretation or Correction of Prequalification Documents: If the Prospective Bidder is in doubt as to the interpretation of any part of the Prequalification Documents, or finds discrepancies in or omissions from any part of the Prequalification Documents, it must submit a written Request for Interpretation thereof no later than [**seven**]<**Insert number**> days prior to acceptance of Submittals of Qualifications. Address all communications to Owner.

1.4 PREQUALIFICATION CRITERIA

A. Prospective Bidders must demonstrate the following to the satisfaction of Owner:

1. Proper license under the laws and regulations governing their respective trade(s).

    a. <**Insert additional licensure requirements**>.

2. Capacity to provide Performance Bond, Labor and Material Payment Bond, and insurance in a form acceptable to Owner in amounts adequate to bond the Work based on the scope indicated in the Advertisement for Prequalification.
3. Applicable experience of firm as described in Contractor's Qualification Statement, including the following:

    a. Experience of Firm: The firm in its current organization must have successfully completed minimum of [**five**]<**Insert number**> projects of similar type, quality, and scope, including a minimum of [**two**]<**Insert number**> within the last [**three**]<**Insert number**> years. The firm must have a record of project completion, credit record, record of judgment claims, arbitration proceedings, and suits pending or outstanding acceptable to Owner.
    b. Experience of Firm Officers: The firm officers must have personal record of project completion acceptable to Owner.
    c. Experience of Project and Field Management Staff to Be Committed by the Prospective Bidder to Carry Out the Work: The assigned project manager and field superintendent must have successfully completed minimum of [**three**]<**Insert number**> projects of similar type, quality, and scope.
    d. For purposes of this submittal, reference to "key individuals," as described in Contractor's Qualification Statement, is to be understood to mean the principal in charge, the project manager(s), and Project field superintendent(s) committed by the Prospective Bidder to carry out the Work of this Project. By submitting qualifications of key individuals, Prospective Bidder agrees that Owner reserves the right to approve or reject subsequent reassignment of key individuals.

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e. For purposes of this submittal, "successful completion" is to be understood to mean completion of Project within Project schedule and budget. Provide additional information indicating reasons why any referenced project did not meet project schedule or project budget.
f. For purposes of this Qualification, "similar project" is to be understood to include the following project elements:

1) Reinforced masonry load-bearing construction.
2) Long-span, steel-framed roof structure.
3) Automated building systems (controls, fire detection and alarm, technology wiring infrastructure, intercommunications).
4) Renovation/addition work on occupied sites.

4. Adequate financial resources, including ability to secure materials and labor necessary for completion of the Work and other work in hand, within the anticipated contract times, and reflecting the anticipated retainage from progress payments.
5. Work-in-hand capacity, such that the Prospective Bidder demonstrates adequate work under contract to continue its business operations at least at their current level, at the same time indicating the capability to carry out Owner's proposed work.
6. Adequate organization to complete work of the scope anticipated, including firm management, project management, field superintendence, and field engineering and quality control.
7. Acceptable past performance as indicated by firm's references, including ability to meet contract time and to monitor, manage, and communicate interim scheduling requirements; carry out required quality-control activities; properly prepare interim and final payment requests; and successfully complete Project closeout requirements.
8. Acceptable documentation of firm's ability to comply with Owner's Minority-owned business enterprise/woman-owned business enterprise (MBE/WBE) requirements. Prospective Bidders are to contact Owner to obtain copies of requirements.
9. Acceptable documentation of firm's employee screening practices as indicating by affidavit describing background check procedures for firm's employees and requirements for same incorporated in firm's subcontracts.
10. <Insert additional qualifications>.

B. Consideration of qualifications may be withheld if the Qualification Statement shows any unexplained erasures, omissions, alterations of form, additions not called for, added restrictions or qualifying conditions, or other irregularities of any kind.

C. Owner may make such investigations as it deems necessary to determine the ability of the Prospective Bidder to perform the Work, and the Prospective Bidder is to furnish to Owner all such information for this purpose as Owner may request. Owner reserves the right to withhold qualification if the evidence submitted by or investigation of such Prospective Bidder fails to satisfy Owner that such Prospective Bidder is properly qualified to carry out the obligations of the proposed Project. The determination of which Bidders are prequalified is not protestable, except as allowed by law.

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D. Prequalification Submittal and data contained therein is considered privileged and confidential and will not be disclosed to any outside party except as required by law.

1.5 BONDS AND INSURANCE

A. The Prospective Bidder is to provide as part of the Submittal of Qualifications evidence of its ability to furnish below:

1. Performance Bond, a Payment Bond, and a Labor and Material Bond, each in the amount of 100 percent of the Contract Sum, with a corporate surety authorized to transact business in Project's jurisdiction.
2. Satisfactory Certificates of Insurance in the amount and types required by statute, but not less than the following:

a. Professional design errors and omissions insurance endorsement for delegated design by Contractor's professional engineer.
b. Workers' Compensation insurance provisions: Statutory limits.
c. Commercial General Liability insurance provisions: At limits established by Owner in Project Contract Documents and including below:

1) [EIFS][Mold] endorsement or separate certificate.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 002115

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DOCUMENT 003119 - EXISTING CONDITION INFORMATION

PART 1 - GENERAL

1.1 EXISTING CONDITION INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Existing Drawings that include information on existing conditions, including previous construction at Project site are available for viewing [**on Project web-based bidding management software site**][**at the office of Architect**][**at the office of Construction Manager**][**at the office of Owner**].

C. Existing [**specifications**][**and**][**submittals**] that include information on existing conditions, including previous construction at Project site are available for viewing [**on Project web-based bidding management software site**][**at the office of Architect**][**at the office of Construction Manager**][**at the office of Owner**].

D. Survey information that includes information on existing conditions, prepared by <**Insert survey firm name**>, dated <**Insert date of survey**>, is available for viewing [**on Project web- based bidding management software site**][**as part of Drawings**].

E. Photographic report of existing conditions that includes photographic documentation on existing conditions, prepared by <**Insert photography firm name**>, dated <**Insert date of report**>, is available [**on Project web-based bidding management software site**][**as appended to this Project Manual**].

F. <**Insert additional information items**> are available for viewing [**on Project web-based bidding management software site**][**at the office of Architect**][**at the office of Construction Manager**][**at the office of Owner**][**as appended to this Project Manual**].

G. Related Requirements:

1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
2. Document 003126 "Existing Hazardous Material Information" for hazardous materials reports that are made available to Bidders.
3. Document 003132 "Geotechnical Data" for reports and soil-boring data from geotechnical investigations that are made available to Bidders.
4. Document 002513 "Prebid Meetings" for site walkthrough.

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PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

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DOCUMENT 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

PART 1 - GENERAL

1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for the Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. An existing mold report for Project, prepared by <**Insert agency or firm name**>, dated <**Insert date of report**>, is available for viewing [**on Project web-based bidding management software site**][**as appended to this Project Manual**].

C. Related Requirements:

1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
2. Document 003119 "Existing Condition Information" for information about existing conditions that is made available to Bidders.
3. Document 003132 "Geotechnical Data" for reports and soil-boring data from geotechnical investigations that are made available to Bidders.
4. Section 011000 "Summary" for description of Owner's separate contracts related to abatement of hazardous materials.
5. Division 02 Sections for abatement of hazardous materials.
6. Section 024116 "Structure Demolition" for notification requirements if materials suspected of containing hazardous materials are encountered.
7. Section 024119 "Selective Demolition" for notification requirements if materials suspected of containing hazardous materials are encountered.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 003126

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DOCUMENT 004100 - BID COVER SHEET

PART 1 - GENERAL

1.1 BID INFORMATION

A. Project Name: <**Insert Project name**>.

B. Bid for Prime Contract: <**Insert prime contract name, if applicable**>.

C. Bidder:

D. Bidder Address:

E. Bid Submitter's Phone Number:

F. Bidder Contractor's License Number:

G. Bid Date:

H. Bid Time: , local time.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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DOCUMENT 004113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

PART 1 - GENERAL

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: <**Insert Project name**>.

C. Project Location: <**Insert Project location**>.

D. Owner: <**Insert name of Owner**>.

E. Owner Project Number: <**Insert Owner Project number**>.

F. Architect: <**Insert name of Architect**>.

G. Architect Project Number: <**Insert Architect Project number**>.

1.2 CERTIFICATIONS AND BASE BID

A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by <**Insert Architect's firm name**> and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services[**, including all scheduled allowances indicated in Section 012100 "Allowances,**] necessary to complete the construction of the above-named Project, in accordance with the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. _____ Dollars ($_____).
2. The above amount may be modified by amounts indicated by the Bidder under [**the "Unit Prices" Article**][**and**][**the "Alternates" Article**] below.

1.3 UNIT PRICES

A. The undersigned Bidder proposes the amounts below be added to or deducted from the Contract Sum on performance and measurement of the individual items of the Work, as described in Section 012200 "Unit Prices"[**and if applicable for adjustment of the quantity given in the Unit-Price Allowance for the actual measurement of individual items of the Work**].

B. If the Unit Price does not affect the Work of this Contract, the Bidder to indicate "NOT

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APPLICABLE."

C. Unit-Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.

1. _____ dollars ($_____) per unit.

D. Unit-Price No. 2: Rock excavation and replacement with satisfactory soil material.

1. _____ dollars ($_____) per unit.

E. Unit-Price No. 3: Cutting and patching of concrete floor slabs.

1. _____ dollars ($_____) per unit.

F. Unit-Price No. 4: Miscellaneous and structural steel.

1. _____ dollars ($_____) per unit.

G. Unit-Price No. <**Insert Unit-Price number**>: <**Insert Unit-Price item**>.

1. _____ dollars ($_____) per unit.

1.4 ALTERNATES

A. The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular Alternates are accepted by Owner. Amounts listed for each Alternate include costs of related coordination, modification, or adjustment.

B. If the Alternate does not affect the Contract Sum, the Bidder to indicate "NO CHANGE."

C. If the Alternate does not affect the Work of this Contract, the Bidder to indicate "NOT APPLICABLE."

D. The Bidder is responsible for determining from the Contract Documents the effects of each Alternate on the Contract Time and the Contract Sum.

E. Owner reserves the right to accept or reject any Alternate, in any order, and to award or amend the Contract accordingly within [**60**]<**Insert number**> days of the Notice of Award unless otherwise indicated in the Contract Documents.

F. Acceptance or non-acceptance of any Alternates by Owner is to have no effect on the Contract Time unless the Alternate description below provides a formatted space for the adjustment of the Contract Time.

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G. Alternate No. <Insert number>: <Insert title of Alternate>:

1. □ ADD □ DEDUCT □ NO CHANGE □ NOT APPLICABLE.
2. _____ Dollars ($_____).
3. Contract Time: Acceptance of this Alternate will add _____ calendar days to the Contract Time.

1.5 BID SECURITY

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within [10]<Insert number> days after a written Notice of Award, if offered within [60]<Insert number> days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached Bid Security, as liquidated damages for such failure as follows:

1. In the following amount constituting 5 percent of the Base Bid amount above:

   a. _____ Dollars ($_____).

2. In the following amount constituting <Insert percentage> of the Base Bid amount above:

   a. _____ Dollars ($_____).

3. In the following amount, as stipulated in Document 002113 "Instructions to Bidders":

   a. _____ Dollars ($_____).

B. Form of Bid Security: Bidder has attached the following:

1. □ AIA Document A310-2010, "Bid Bond."
2. □ Cashier's check.
3. □ Certified check.

C. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cashier's check, certified check, or bid bond.

1.6 SUBCONTRACTORS AND SUPPLIERS

A. The following companies to execute subcontracts for the portions of the Work indicated:

1. Concrete Work:

   _____.

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2. Masonry Work:
   _____.
3. Roofing Work:
   _____.
4. Plumbing Work:
   _____.
5. HVAC Work:
   _____.
6. Electrical Work:
   _____.

1.7 TIME OF COMPLETION

A. Time of Completion:

1. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and to substantially complete the Work within <**Insert number**> calendar days.
2. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and to substantially complete the Work within _____ calendar days.

1.8 ACKNOWLEDGMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.

1.9 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto:

1. <**Insert name of Bid Form supplement**>.

1.10 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in <**Insert Project jurisdiction**>, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

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1.11 SUBMISSION OF BID

A. Respectfully submitted this ____ day of _____ <**Insert month and year**>.

B. Submitted by: _____ (Name of bidding firm or corporation).

C. Authorized Signature: _____ (Handwritten signature).

D. Signed by: _____ (Type or print name).

E. Title: _____ (Owner/Partner/President/Vice President).

F. Witnessed by: _____ (Handwritten signature).

G. Attest: _____ (Handwritten signature).

H. By: _____ (Type or print name).

I. Attester Title: _____ (Corporate Secretary or Assistant Secretary).

J. Street Address:
_____.

K. City, State, Zip:
_____.

L. Phone:
_____
_.

M. License No.:
_____.

N. Federal ID No.:
_____.

O. (Affix Corporate Seal Here)

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PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 004113

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SECTION 010000 - GENERAL REQUIREMENTS

PART 1 - GENERAL (Not Used)
PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 010000

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work performed by Owner.
5. Multiple Work Packages.
6. Work under Owner's separate contracts.
7. Future work not part of this Project.
8. Owner's product purchase contracts.
9. Owner-furnished/Contractor-installed (OFCI) products.
10. Owner-furnished/Owner-installed (OFOI) products.
11. Contractor-furnished/Owner-installed (CFOI) products.
12. Contractor's use of site and premises.
13. Coordination with occupants.
14. Work restrictions.
15. Specification and Drawing conventions.
16. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Contingency allowances.
5. Testing and inspecting allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.2 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.3 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

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PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Quantity Allowance: Include 2000 cu. yd. of unsatisfactory soil excavation and disposal off-site and replacement with satisfactory soil material from off-site, as specified in Section 312000 "Earth Moving."

1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

B. Allowance No. 2: Quantity Allowance: Include 1000 cu. yd. of mass rock removal and replacement with satisfactory soil material, as specified in Section 312000 "Earth Moving."

1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

C. Allowance No. 3: Quantity Allowance: Include 10 cu. yd. of trench rock removal and replacement with satisfactory soil material, as specified in Section 312000 "Earth Moving."

1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

D. Allowance No. 4: Lump-Sum Allowance: Include the sum of $30,000.00 for three chandeliers for the main lobby, as specified in [**Section 265113 "Incandescent Interior Lighting."**][**Section 265119 LED "Interior Lighting."**]

1. This allowance includes material, receiving, handling, and installation costs, and Contractor overhead and profit.

E. Allowance No. 5: Unit-Cost Allowance: Include the sum of $350.00 per thousand for buff-colored face brick, as specified in Section 042000 "Unit Masonry" and as shown on Drawings.

F. Allowance No. 6: Quantity Allowance: Include 5000 sq. yd. of Carpet Type 1 installed, including urethane foam carpet cushion and related amount of tackless strip, as specified in Section 096816 "Sheet Carpeting."

G. Allowance No. 7: Contingency Allowance: Include a contingency allowance of $100,000.00 for use according to Owner's written instructions.

H. Allowance No. 8: Testing and Inspection Allowance: Include the sum of $1,000.00 for testing concrete to be provided by Owner, as specified in Section 033000 "Cast-in-Place Concrete."

I. Allowance No. <**Insert number**>: [**Lump-Sum**][**Unit-Cost**][**Quantity**][**Contingency**][**Testing and Inspecting**] Allowance: Include the sum of

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<Insert dollar or quantity amount of allowance>. Include <Insert allowance description>, as specified in Section <Insert Section number> "<Insert Section title>"[and as shown on Drawings].

1. This allowance includes [material cost][receiving, handling, and installation][and][Contractor overhead and profit].
2. Coordinate quantity allowance adjustment with corresponding unit-price requirements in Section 012200 "Unit Prices."

END OF SECTION 012100

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SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.

1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
2. Unit of Measurement: <**Insert** cubic yard> of soil excavated, based on in-place surveys of volume before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. Unit Price No. 2: Mass rock excavation and replacement with satisfactory soil material.

1. Description: Classified mass rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
2. Unit of Measurement: <**Insert** cubic yard> of rock excavated, based on in-place surveys of volume before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

C. Unit Price No. 3: Trench rock excavation and replacement with satisfactory soil material.

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1. Description: Classified trench rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
2. Unit of Measurement: <Insert cubic yard> of rock excavated, based on survey of in-place surveys volume of before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

D. Unit Price No. 4: Cutting and patching of concrete slabs-on-grade.

1. Description: Cutting of new or existing concrete slabs-on-grade up to [6 inches]<Insert dimension> thick, removal and excavation as required, and subsequent backfill, compaction, and patching of concrete in accordance with Section 017300 "Execution." not otherwise indicated in the Contract Documents.
2. Unit of Measurement: <Insert square feet> of concrete removed.

E. Unit Price No. 5: Miscellaneous and structural steel.

1. Description: Miscellaneous lintels and other supports not otherwise indicated in the Contract Documents, in accordance with Section 051200 "Structural Steel Framing" and Section 055000 "Metal Fabrications."
2. Unit of Measurement: Cost in place of <Insert pounds> of fabricated steel, as indicated on itemized invoice of steel supplier.

F. Unit Price No. 6: Elevator jack hole rock.

1. Description: Subsurface soil conditions that refuse conventional auger excavation of the elevator jack hole, in accordance with Section 142400 "Hydraulic Elevators."
2. Unit of Measurement: Depth in <Insert feet> of drilling required, as indicated on the elevator Installer's invoice.
3. Assigned Unit Cost: Owner will pay [$250.00]<Insert dollar amount> per unit <Insert feet> of rock drilling required.

G. Unit Price No. <Insert unit-price number> - <Insert unit-price item>:

1. Description: <Insert unit-price item description> in accordance with Section <Insert Section number> "<Insert Section title>."
2. Unit of Measurement: <Insert unit of measurement>.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION 012200

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SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. <**Insert number**>: <**Insert title of alternate**>.

1. Base Bid: <**Insert brief description of base-bid requirement**> as indicated on Drawing <**Insert title of Drawing**> and as specified in Section <**Insert Section number**> "<**Insert Section title**>."
2. Alternate: <**Insert brief description of alternate requirement**> as indicated on Drawing <**Insert title of Drawing**> and as specified in Section <**Insert Section number**> "<**Insert Section title**>."

END OF SECTION 012300

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SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Document 002600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
2. Section 012100 "Allowances" for products selected under an allowance.
3. Section 012300 "Alternates" for products selected under an alternate.
4. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form [**provided in Project Manual**][**that is part of web-based Project management software**][**acceptable to Architect**].
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and

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interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from [ICC-ES]<Insert applicable code organization>.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within [seven]<Insert number> days of receipt of a request for substitution. Architect will notify Contractor[through Construction Manager] of acceptance or rejection of proposed substitution within [15]<Insert number> days of receipt of request, or [seven]<Insert number> days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.3 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

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SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Document 004373 "Proposed Schedule of Values Form" for requirements for furnishing proposed schedule of values with bid.
2. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
3. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
4. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
5. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
6. Section 018113.13 "Sustainable Design Requirements - LEED 2009 for New Construction and Major Renovations" for administrative requirements governing submittal of cost breakdown information required for sustainable design documentation.
7. Section 018113.16 "Sustainable Design Requirements - LEED 2009 for Commercial Interiors" for administrative requirements governing submittal of cost breakdown information required for sustainable design documentation.
8. Section 018113.19 "Sustainable Design Requirements - LEED 2009 for Core and Shell Development" for administrative requirements governing submittal of cost breakdown information required for sustainable design documentation.
9. Section 018113.23 "Sustainable Design Requirements - LEED 2009 for Schools" for administrative requirements governing submittal of cost breakdown information required for sustainable design documentation.
10. Section 018113.14 "Sustainable Design Requirements - LEED v4 BD+C" for administrative requirements governing submittal of cost breakdown information required for sustainable design documentation.
11. Section 018113.17 "Sustainable Design Requirements - LEED v4 ID+C" for administrative requirements governing submittal of cost breakdown information required for sustainable design documentation.
12. Section 018113.43 "Sustainable Design Requirements - ASHRAE 189.1" for administrative requirements governing submittal of cost breakdown information required for sustainable design documentation.
13. Section 018113.53 "Sustainable Design Requirements - Green Globes" for administrative requirements governing submittal of cost breakdown information required for sustainable design documentation.

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PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Web-based Project management software package.
6. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
5. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.2 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within [15]<Insert number> days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and

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responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office,[**in web-based Project software directory,**] and in prominent location in[**each**] built facility. Keep list current at all times.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for preparing a combined Contractor's Construction Schedule.
2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
3. Section 014000 "Quality Requirements" for schedule of tests and inspections.

1.2 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.
3. [Two]<Insert number> paper copies, of sufficient size to display entire period or schedule, as required.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

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E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports to contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from [**commencement of the Work**][**the Notice to Proceed**] until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at [**weekly**][**monthly**] intervals.

H. Material Location Reports: Submit at [**weekly**][**monthly**] intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.3 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including [**phasing**][**work stages**][**area separations**][**interim milestones**][**and**][**partial Owner occupancy**].
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures[**, including commissioning activities**].

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10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

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SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Time-lapse sequence construction photographs.
5. Final Completion construction photographs.
6. Preconstruction video recordings.
7. Periodic construction video recordings.
8. Time-lapse sequence construction video recordings.
9. Construction webcam.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
3. Section 024116 "Structure Demolition" for photographic documentation before building demolition operations commence.
4. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
5. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each [**photograph**][**and**][**video recording**]. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within [**three**]<**Insert number**> days of taking photographs.

1. Submit photos [**on CD-ROM or thumb-drive**][**by uploading to web-based Project management software site**]. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description [**in file metadata tag**][**in web-based Project management software site**]:

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a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect[and Construction Manager].
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

C. Printed Photographs: Submit [two]<Insert number> sets of prints of each photographic view within [seven]<Insert number> days of taking photographs.

1. Format: 8-by-10-inch smooth-surface matte prints on single-weight, paper; enclosed back to back in clear plastic sleeves punched for three-ring binder. Include copy of key plan indicating each photograph's location and direction. Provide one binder for each set of prints.
2. Identification: On back of each print, label with the following information:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect[and Construction Manager].
d. Name of Contractor.
e. Date photograph was taken if not date stamped by camera.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier keyed to accompanying key plan.

D. Video Recordings: Submit video recordings within [seven]<Insert number> days of recording.

1. Submit video recordings [on CD-ROM or thumb drive][by uploading to web-based Project management software site]. Include copy of key plan indicating each video's location and direction.
2. Identification: With each submittal, provide the following information [in file metadata tag][on web-based Project management software site]:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect[and Construction Manager].
d. Name of Contractor.
e. Date video recording was recorded.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

3. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in three-ring binders. Provide label on front and spine. Include a cover sheet with label information. Include name of Project and date of video recording on each page.

E. Time-Lapse Video: Submit time-lapse sequence video recordings within <Insert number> days of recording.

1. Submit time-lapse sequence video recordings [monthly]<Insert frequency>[on

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CD-ROM or thumb drive][by uploading to web-based Project management software site].

2. Identification: For each recording, provide the following information [in file metadata tag][on web-based Project management software site]:

   a. Name of Project.
   b. Name and contact information for photographer.
   c. Name of Architect[and Construction Manager].
   d. Name of Contractor.
   e. Date(s) and time(s) video recording was recorded.
   f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

B. Construction Webcam Service Provider: A firm specializing in providing photographic equipment, web-based software, and related services for construction projects, with a record of providing satisfactory services similar to those required for Project.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
10. Section 018113.13 "Sustainable Design Requirements - LEED 2009 for New Construction and Major Renovations" for sustainable design submittals.
11. Section 018113.16 "Sustainable Design Requirements - LEED 2009 for Commercial Interiors" for sustainable design submittals.
12. Section 018113.19 "Sustainable Design Requirements - LEED 2009 for Core and Shell Development" for sustainable design submittals.
13. Section 018113.23 "Sustainable Design Requirements - LEED 2009 for Schools" for sustainable design submittals.
14. Section 018113.14 "Sustainable Design Requirements - LEED v4 BD+C" for sustainable design submittals.
15. Section 018113.17 "Sustainable Design Requirements - LEED v4 ID+C" for sustainable design submittals.
16. Section 018113.33 "Sustainable Design Requirements - IgCC" for sustainable design submittals.
17. Section 018113.43 "Sustainable Design Requirements - ASHRAE 189.1" for

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sustainable design submittals.

18. Section 018113.53 "Sustainable Design Requirements - Green Globes" for sustainable design submittals.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

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SECTION 013516 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special procedures for alteration work.

1.2 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:

1. Submit alteration work subschedule within [**seven**][**30**]<**Insert number**> days of date established for[**commencement of alteration work**]<**Insert requirement**>.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

C. Alteration Work Program: Submit 30 days before work begins.

D. Fire-Prevention Plan: Submit 30 days before work begins.

1.3 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.

1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

a. Construct new mockups of required work whenever a supervisor is replaced.

B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

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1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSP A10.6.

1.4 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of measured drawings preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Owner's Removals: Before beginning alteration work, verify in correspondence with Owner that the following items have been removed:

1. Trash.

D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

PART 2 - PRODUCTS - (Not Used)
PART 3 - EXECUTION

3.1 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to

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which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

END OF SECTION 013516

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SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering.
3. Installation.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 011000 "Summary" for coordination of [**Owner-furnished products**][**, Owner-performed work**][**, Owner's separate contracts**], and limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Prior to [**submitting cutting and patching plan**][**commencing work requiring cutting and patching**], review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect[**and Construction Manager**] of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

a. Contractor's superintendent.
b. Trade supervisor responsible for cutting operations.

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c. Trade supervisor(s) responsible for patching of each type of substrate.
d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Prior to establishing layout of [**new**][**new and existing**] perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect[**and Construction Manager**] of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:

a. Contractor's superintendent.
b. [**Professional surveyor**][**Professional engineer**][**Contractor's personnel**] responsible for performing Project surveying and layout.
c. [**Professional surveyor**][**Professional engineer**] responsible for performing site survey serving as basis for Project design.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [**land surveyor**][**professional engineer**].

B. Certified Surveys: Submit [**two**]<**Insert number**> copies signed by [**land surveyor**][**professional engineer**].

C. Certificates: Submit certificate signed by [**land surveyor**][**professional engineer**], certifying that location and elevation of improvements comply with requirements.

D. Cutting and Patching Plan: Submit plan describing procedures at least [**10**]<**Insert number**> days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.

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5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.4 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit [10]<Insert number> copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.[Operational elements include the following:]

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Plumbing piping systems.
    f. Mechanical systems piping and ducts.
    g. Control systems.
    h. Communication systems.
    i. Fire-detection and -alarm systems.
    j. Conveying systems.
    k. Electrical wiring systems.

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l. Operating systems of special construction.
m. <Insert operating system>.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.[Other construction elements include but are not limited to the following:]

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Exterior curtain-wall construction.
d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.
h. <Insert miscellaneous element>.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially

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hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of [96 inches]<**Insert dimension**> in occupied spaces and [90 inches]<**Insert dimension**> in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and

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directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous [**demolition**][**and**][**construction**] waste.
2. Recycling nonhazardous [**demolition**][**and**][**construction**] waste.
3. Disposing of nonhazardous [**demolition**][**and**][**construction**] waste.

1.2 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within [**7**][**30**]<**Insert number**> days of date established for [**commencement of the Work**][**the Notice to Proceed**][**the Notice of Award**]. Plan must include the following:

1. Strategies to reduce the generation of waste during Project design and construction.
2. Waste diversion goals for Project, identifying the materials (both structural and nonstructural) targeted for recycling, reuse, or salvage and identifying the target diversion percentage (at least 50 percent).
3. Where materials will be taken, including expected diversion rates for each material.

1.3 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use [**Form CWM-7 for construction waste**][**and**][**Form CWM-8 for demolition waste**]<**Insert Owner's form designation**>. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in **tons**.
4. Quantity of waste salvaged, both estimated and actual in **tons**.
5. Quantity of waste recycled, both estimated and actual in **tons**.
6. Total quantity of waste recovered (salvaged plus recycled) in **tons**.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

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C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. LEED Submittal: Submit documentation to GBCI, signed by Contractor, tabulating total waste material, quantities diverted, and means by which it is diverted, along with a statement that requirements for the credit have been met. Respond to questions and requests from USGBC regarding construction waste management and disposal until the GBCI Reviewer has made its determination on Project's LEED certification application. Document correspondence with USGBC as informational submittals.

H. Qualification Statements: For [**waste management coordinator**][**and**][**refrigerant recovery technician**].

I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.

J. Refrigerant Recovery: Comply with requirements in [**Section 024116 "Structure Demolition"**][**Section 024119 "Selective Demolition"**] for refrigerant recovery submittals.

1.4 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent [**may**][**may not**] serve as Waste Management Coordinator.

1. Firm employs a LEED Accredited Professional, certified by USGBC, as waste management coordinator.
2. Waste management coordinator may also serve as LEED coordinator.

B. Refrigerant Recovery Technician Qualifications:

1. [**Type I**][**Type II**][**Type III**][**Universal**], certified by EPA-approved certification program.
2. Comply with requirements in [**Section 024116 "Structure Demolition."**][**Section 024119 "Selective Demolition."**]

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C. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation, and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of [50][75]<Insert number> percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials[.][, including the following:]

1. Demolition Waste:

a. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. CMU.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.

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t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.
pp. <**Insert materials required**>.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Wood pallets.
8) Plastic pails.

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m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:

1) Paper.
2) Aluminum cans.
3) Glass containers.

n. <**Insert materials required**>.

PART 3 - EXECUTION (Not Used)

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

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PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION (Not Used)

END OF SECTION 017700

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SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Removal and salvage of existing items for delivery to Owner and removal of existing items for reinstallation.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.
6. Section 330500 "Common Work Results for Utilities" for removal of site utility systems piping, equipment, and components.

1.2 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.
6. Review and finalize protection requirements.
7. Review procedures for noise control.
8. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

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1.3 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property[, for environmental protection][, for dust control][and][, for noise control]. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.

E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.4 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.5 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Type III certified by an EPA-approved certification program.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted in occupied commercial spaces.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

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a. <Insert items to be removed by Owner>.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials:

1. It is not expected that hazardous materials will be encountered in the Work.

a. Hazardous materials will be removed by Owner before start of the Work.
b. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

2. Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is [on file][included in Section 003126 "Existing Hazardous Material Information"] for review and use. Examine report to become aware of locations where hazardous materials are present.

a. Hazardous material remediation is specified in Section <Insert Section number> "<Insert Section title>."
b. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified in Section <Insert Section number> "<Insert Section title>."
c. Owner will provide material safety data sheets for hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

E. On-site sale of removed items or materials is not permitted.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

1. <Insert warranted system>.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

C. Sustainable Design Requirements for Building Reuse:

1. Maintain the existing building structure, envelope, and interior nonstructural elements of an abandoned or blighted building. Do not demolish such existing construction beyond indicated limits.
2. Maintain the existing building structural systems where indicated to remain. Do not demolish such existing construction beyond indicated limits.
3. Maintain the existing interior ceilings, interior partitions, and/or demountable walls where indicated to remain. Do not demolish such existing construction beyond indicated limits.

PART 3 - EXECUTION

3.1 UTILITY SERVICES AND BUILDING SYSTEMS

A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
4. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

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c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.

5. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.

   a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
   b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

6. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:

   a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
   b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

3.2 SELECTIVE DEMOLITION SCHEDULE

A. Remove: <**Insert description of items and construction to remove**>.

B. Remove and Salvage: <**Insert description of items to remove and salvage**>.

C. Remove and Reinstall: <**Insert description of items to remove and reinstall**>.

D. Existing to Remain: <**Insert description of items to remain**>.

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SECTION 030130 - MAINTENANCE OF CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal of deteriorated concrete and subsequent replacement and patching.
2. Floor joint repair.
3. Epoxy crack injection.
4. Drying process

    a. Remove standing water
    b. Enhance air circulation w/ fresh air, fans, and dehumidifiers
    c. Monitor Drying process

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1. Unit prices apply to authorized work covered by [**quantity allowances**][**estimated quantities**].
2. Unit prices apply to authorized additions to and deletions from the Work as authorized by Change Orders.

B. General: Unit prices include the cost of preparing existing construction to receive the work indicated[**and costs of field quality control required for units of work completed**].

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete maintenance including, but not limited to, the following:

    a. Verify concrete-maintenance specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Materials, material application, sequencing, tolerances, and required clearances.
    c. Quality-control program.
    d. Coordination with building occupants.
    e. <**Insert agenda items**>.

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1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

B. Samples: Cured Samples for each exposed product and for each color and texture specified, in manufacturer's standard size appropriate for each type of work.

C. Samples for Initial Selection: Cured Samples for each exposed product and for each color and texture.

1. Include sets of patching-material Samples in the form of briquettes, at least 3 inches long by 1-1/2 inches wide representative of the range of concrete colors on the building. Document each Sample with product, mix, and or other information necessary to replicate it.
2. Include sets of Samples for epoxy crack-injection adhesive and capping adhesive in the form of injection-treated, whole, dense concrete block or brick units representative of the range of required adhesive colors.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturers.

B. Material Certificates: For each type of portland cement aggregate ready-mix concrete supplied for mixing or adding to products at Project site.

C. Product Test Reports: For each cementitious patching mortar joint-filler, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Field quality-control reports.

E. Quality-Control Program: Submit before work begins.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Each packaged patching-mortar joint-filler crack-injection-adhesive manufacturer shall employ factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.

B. Concrete-Maintenance Specialist Qualifications: Engage an experienced concrete-maintenance firm that employs installers and supervisors who are trained and approved by manufacturer to apply crack-injection adhesive to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing or patching new concrete is insufficient experience for concrete-maintenance work.

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1. Field Supervision: Concrete-maintenance specialist firm shall maintain experienced full-time supervisors on Project site during times that concrete-maintenance work is in progress.

C. Quality-Control Program: Prepare a written plan for concrete maintenance to systematically demonstrate the ability of personnel to properly perform maintenance work, including each phase or process, protection of surrounding materials during operations, and control of debris and runoff during the Work. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Concrete Removal and Patching: Remove and repair an [**approximately 50 sq. ft.**][**approximately 100 sq. in.**]<**Insert dimension**> area of [**deteriorated concrete deck**][**deteriorated concrete wall**]<**Insert description**>.
2. Floor Joint Repair: Cut out and reinstall joints in two separate areas [**, each approximately 48 inches long**][**as indicated on Drawings**]<**Insert dimension**>.
3. Epoxy Crack Injection: Perform epoxy crack injection in two separate areas [**, each approximately 48 inches long**][**as indicated on Drawings**]<**Insert dimension**>.
4. Polymer Overlay: Apply an [**approximately 50 sq. ft.**]<**Insert dimension**> area of polymer overlay.
5. Polymer Sealer: Apply an [**approximately 50 sq. ft.**]<**Insert dimension**> area of polymer sealer.
6. Composite Structural Reinforcement: Apply composite structural reinforcement [**a minimum of 48 inches long**][**as indicated on Drawings**]<**Insert dimension**>.
7. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
8. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

B. Store cementitious materials off the ground, under cover, and in a dry location.

C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.8 FIELD CONDITIONS

A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused

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mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

1. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F within eight hours.
2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F within eight hours.
3. Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 deg F for eight hours.

B. Cold-Weather Requirements for Cementitious Materials:

1. Do not apply unless concrete-surface and air temperatures are above 40 deg F and will remain so for at least 48 hours after completion of Work.
2. Comply with the following procedures:

   a. When air temperature is below 40 deg F, heat patching-material ingredients and existing concrete to produce temperatures between 40 and 90 deg F.
   b. When mean daily air temperature is between 25 and 40 deg F, cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair.
   c. When mean daily air temperature is below 25 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair.

C. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F and above.

D. Environmental Limitations for High-Molecular-Weight Methacrylate Sealers: Do not apply when concrete surface temperature is below 55 deg F or above [75 deg F][90 deg F]<**Insert temperature**>. Apply only to [**dry substrates**][**substrates that have been dry for at least 72 hours**].

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. For repair products, obtain each color, grade, finish, type, and variety of product from single source and from single manufacturer with resources to provide products of consistent quality in appearance and physical properties.

2.2 PREPLACED CONCRETE MATERIALS

A. Preplaced Aggregate: Washed aggregate, ASTM C33/C33M, Class 5S, with [**95 to 100**

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percent passing a 1-1/2-inch sieve, 40 to 80 percent passing a 1-inch sieve, 20 to 45 percent passing a 3/4-inch sieve, zero to 10 percent passing a 1/2-inch sieve, and zero to 2 percent passing a 3/8-inch sieve][**100 percent passing a 1-1/2-inch sieve, 95 to 100 percent passing a 1-inch sieve, 40 to 80 percent passing a 3/4-inch sieve, zero to 15 percent passing a 1/2-inch sieve, and zero to 2 percent passing a 3/8-inch sieve**]<**Insert requirement**>.

B. Fine Aggregate for Grout: Fine aggregate according to ASTM C33/C33M, but with 100 percent passing a No. 8 sieve, 95 to 100 percent passing a No. 16 sieve, 55 to 80 percent passing a No. 30 sieve, 30 to 55 percent passing a No. 50 sieve, 10 to 30 percent passing a No. 100 sieve, zero to 10 percent passing a No. 200 sieve, and having a fineness modulus of 1.30 to 2.10.

C. Grout Fluidifier for Grout: ASTM C937.

D. Pozzolans for Grout: ASTM C618.

2.3 MISCELLANEOUS MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I, II, or III unless otherwise indicated.

B. Water: Potable.

2.4 MIXES

A. General: Mix products, in clean containers, according to manufacturer's written instructions.

1. Do not add water, thinners, or additives unless recommended by manufacturer.
2. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
3. Do not mix more materials than can be used within time limits recommended by manufacturer. Discard materials that have begun to set.

B. Mortar Scrub Coat: Mix dry ingredients with enough water to provide consistency of thick cream.

C. Dry-Pack Mortar: Mix required type(s) of patching-mortar dry ingredients with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.

D. Concrete: Comply with [**Section 033000 "Cast-in-Place Concrete."**][**Section 033300 "Architectural Concrete."**]

E. Grout for Use with Preplaced Aggregate: Proportion according to ASTM C938. Add grout fluidifier to mixing water followed by portland cement, pozzolan, and fine aggregate.

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PART 3 - EXECUTION

3.1 CONCRETE-MAINTENANCE SPECIALIST

A. Concrete-Maintenance Specialist Firms: Subject to compliance with requirements, [**have concrete maintenance performed by one of the following**][**firms that may perform concrete maintenance include, but are not limited to, the following**]:

1. <**Insert, in separate subparagraphs, names of concrete-maintenance specialist firms**>.

3.2 CONCRETE MAINTENANCE

A. Have concrete-maintenance work performed only by qualified concrete-maintenance specialist.

B. Comply with manufacturers' written instructions for surface preparation and product application.

3.3 EXAMINATION

A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.

B. Locate areas of deteriorated or delaminated concrete using hammer or chain-drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls make boundaries level and plumb unless otherwise indicated.

C. Pachometer Testing: Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer using depth of cover measurements, and verify depth of cover in removal areas using pachometer.

D. Perform surveys as the Work progresses to detect hazards resulting from concrete-maintenance work.

3.4 PREPARATION

A. Ensure that supervisory personnel are on-site and on duty when concrete maintenance work begins and during its progress.

B. Protect persons, motor vehicles, surrounding surfaces of building being repaired, building site, plants, and surrounding buildings from harm resulting from concrete maintenance work.

1. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on

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people and adjacent materials, components, and vegetation.

2. Use only proven protection methods appropriate to each area and surface being protected.
3. Provide temporary barricades, barriers, and directional signage to exclude public from areas where concrete maintenance work is being performed.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of concrete maintenance work.
5. Contain dust and debris generated by concrete maintenance work and prevent it from reaching the public or adjacent surfaces.
6. Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment that ensure that such water will not create a hazard or adversely affect other building areas or materials.
7. Protect floors and other surfaces along haul routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate removal and dismantling work from other areas of the building.
9. Protect adjacent surfaces and equipment by covering them with heavy polyethylene film and waterproof masking tape[**or a liquid strippable masking agent**]. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
10. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
11. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

C. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.

1. Prevent solids such as aggregate or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete maintenance work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

D. Preparation for Concrete Removal: Examine construction to be repaired to determine best methods to safely and effectively perform concrete maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.

1. Verify that affected utilities have been disconnected and capped.
2. Inventory and record the condition of items to be removed for reinstallation or salvage.
3. Provide and maintain shoring, bracing, and temporary structural supports as required to preserve stability and prevent unexpected or uncontrolled movement, settlement, or collapse of construction being demolished and construction and finishes to remain. Strengthen or add new supports when required during progress of removal work.

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E. Reinforcing-Bar Preparation: Remove loose and flaking rust from exposed reinforcing bars by [**high-pressure water cleaning**][**abrasive blast cleaning**][**needle scaling**][**or**][**wire brushing**] until only tightly adhered light rust remains.

1. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in two or more adjacent bars, cut bars and remove and replace as indicated on Drawings.
2. Remove additional concrete as necessary to provide at least **3/4-inch** clearance at existing and replacement bars.
3. Splice replacement bars to existing bars according to **ACI 318** by lapping, welding, or using mechanical couplings.

F. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than [**3/4 inch**][**1 inch**][**2 inches**]<**Insert dimension**> deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.

G. Surface Preparation for Corrosion-Inhibiting Treatment: Clean concrete to remove dirt, oils, films, and other materials detrimental to treatment application.

1. Use [**low-pressure water cleaning**][**detergent scrubbing**][**or**][**sand blasting**]<**Insert requirement**>.
2. Allow surface to dry before applying corrosion-inhibiting treatment.

H. Surface Preparation for Overlays:

1. Remove delaminated material and deteriorated concrete surface material.
2. Roughen surface of concrete to produce a surface profile matching CSP [**3**][**4**][**5**][**6**][**7**][**8**][**9**] according to ICRI 310.2.
3. Use [**sand blasting**][**shot blasting**][**scarifying**][**needle scaling**][**high-pressure water jetting**][**scabbling**][**flame blasting**][**or**][**milling**]<**Insert requirement**>.
4. Sweep and vacuum roughened surface to remove debris[**followed by low-pressure water cleaning**].

I. Acidic Surface Preparation for Sealers: Acid etch surface of concrete to produce a surface profile matching CSP 1 according to ICRI 310.2.[**Prepare surface for acid etching by detergent scrubbing to remove oils and films that may prevent acid penetration.**]

1. Remove excess acid solution, reaction products, and debris by squeegeeing or vacuuming.
2. Scrub surface with an alkaline detergent, rinse, and squeegee or vacuum.
3. Check acidity of surface with pH test paper and continue rinsing until pH is acceptable according to sealer manufacturer's written instructions.
4. When pH is acceptable according to sealer manufacturer's written instructions and surface is clean, vacuum dry.

J. Nonacidic Surface Preparation for Sealers: Clean concrete to remove dirt, oils, films, and other materials detrimental to sealer application.

1. Use [**shot blasting**][**low-pressure water cleaning**][**or**][**detergent scrubbing**]<**Insert requirement**>.

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K. Surface Preparation for Composite Structural Reinforcement: Clean concrete where reinforcement and epoxy patching mortar is to be placed by [**low-pressure water cleaning**][**or**][**detergent scrubbing**]<**Insert requirement**> to remove dirt, oils, films, and other materials detrimental to epoxy patching mortar.

1. Roughen surface of concrete by sand blasting.
2. Remove delaminated material and deteriorated concrete surface material.
3. Sweep and vacuum roughened surface to remove debris[**followed by low-pressure water cleaning**].

3.5 REMOVAL OF CONCRETE

A. Do not overload structural elements with debris.

B. Saw-cut perimeter of areas indicated for removal to a depth of at least [1/2 inch]<**Insert dimension**>. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.

C. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.

D. Remove additional concrete if necessary to provide a depth of removal of at least [1/2 inch]<**Insert dimension**> over entire removal area.

E. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least 3/4-inch clearance around bar.

F. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.

G. Provide surfaces with a fractured profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level unless otherwise directed.

H. Thoroughly clean removal areas of loose concrete, dust, and debris.

3.6 APPLICATION OF BONDING AGENT

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars [**and concrete**]by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.

B. Epoxy Bonding Agent: Apply to reinforcing bars[**and concrete**] by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas.[**Apply to reinforcing bars in at least two coats, allowing first coat to dry**

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before applying second coat.] Place patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar or concrete.

C. Latex Bonding Agent, Type I: Apply to concrete by brush roller or spray. Allow to dry before placing patching mortar or concrete.

D. Latex Bonding Agent, Type II: Mix with portland cement and scrub into concrete surface according to manufacturer's written instructions. Place patching mortar or concrete while bonding agent is still wet. If bonding agent dries, recoat before placing patching mortar or concrete.

E. Mortar Scrub Coat for Job-Mixed Patching Mortar[**and Concrete**]: Dampen repair area and surrounding concrete 6 inches beyond repair area. Remove standing water and apply scrub coat with a brush, scrubbing it into surface and thoroughly coating repair area. If scrub coat dries, recoat before placing patching mortar or concrete.

F. Slurry Coat for Cementitious Patching Mortar: Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar[**mixed with latex bonding agent**] into substrate, filling pores and voids.

3.7 INSTALLATION OF DRY-PACK-MORTAR

A. Use dry-pack mortar for deep cavities[**and where indicated**]. Place as specified in this article unless otherwise recommended in writing by manufacturer.

1. Provide forms where necessary to confine patch to required shape.
2. Wet substrate and forms thoroughly and then remove standing water.

B. Pretreatment: Apply specified [**bonding agent**][**mortar scrub coat**][**slurry coat**][**bonding agent and slurry coat**]<**Insert requirement**>.

C. Place dry-pack mortar into cavity by hand, and compact tightly into place. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.

D. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete. A thin coat of patching mortar may be troweled into the surface of patch to help obtain required finish.

E. Wet-cure patch for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.8 CONCRETE PLACEMENT

A. Place concrete according to [**Section 033000 "Cast-in-Place Concrete"**][**Section 033300 "Architectural Concrete"**] and as specified in this article.

B. Epoxy-Modified Pretreatment: Apply [**epoxy-modified, cementitious bonding and anticorrosion agent**][**epoxy bonding agent**]<**Insert requirement**> to reinforcement[**and**

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concrete substrate].

C. Latex Pretreatment: Apply [**latex bonding agent**][**Type I latex bonding agent**][**mortar scrub coat**]<**Insert requirement**> to concrete substrate.

D. Standard Placement: Place concrete by form-and-pump method unless otherwise indicated.

1. Use vibrators to consolidate concrete as it is placed.
2. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.

E. Form-and-Pump Placement: Place concrete by form-and-pump method where indicated.

1. Design and construct forms to resist pumping pressure in addition to weight of wet concrete. Seal joints and seams in forms and where forms abut existing concrete.
2. Pump concrete into place from bottom to top, releasing air from forms as concrete is introduced. When formed space is full, close air vents and pressurize to 14 psi.

F. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.

G. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.

3.9 GROUTING PREPLACED AGGREGATE CONCRETE

A. Use grouted preplaced aggregate concrete [**where indicated**][**for column and wall repairs**]<**Insert requirement**>. Place as specified in this article.

B. Design and construct forms to resist pumping pressure in addition to weight of wet grout. Seal joints and seams in forms and where forms abut existing concrete.

C. Apply [**epoxy-modified cementitious bonding and anticorrosion agent**][**epoxy bonding agent**] to reinforcement[**and concrete substrate**].

D. Place aggregate in forms, consolidating aggregate in lifts as it is placed. Pack aggregate into upper areas of forms to achieve intimate contact with concrete surfaces.

E. Fill forms with water to thoroughly dampen aggregate and substrates. Drain water from forms before placing grout.

F. Pump grout into place at bottom of preplaced aggregate, forcing grout upward. Release air from forms at top as grout is introduced. When formed space is full and grout flows from air vents, close vents and pressurize to 14 psi.

G. Wet-cure concrete for not less than seven days by leaving forms in place or keeping

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surfaces continuously wet by water-fog spray or water-saturated absorptive cover.

H. Repair voids with patching mortar and finish to match surrounding concrete.

3.10 FLOOR-JOINT REPAIR

A. Cut out deteriorated concrete [**and reconstruct sides of joint with patching mortar**]<**Insert requirement**> as indicated on Drawings. Install joint filler in nonmoving floor joints where indicated and as specified in this article.

B. Depth: Install joint filler to a depth of at least [3/4 inch][1 inch][2 inches]<**Insert dimension**>. Use fine silica sand no more than 1/4 inch deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.

C. Top Surface: Install joint filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

3.11 EPOXY CRACK INJECTION

A. Clean cracks with oil-free compressed air or low-pressure water to remove loose particles.

B. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond.

C. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.

D. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch thick by 1 inch wider than crack.

E. Inject cracks wider than 0.003 inch to a depth of 8 inches.

F. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.

G. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

3.12 APPLICATION OF CORROSION-INHIBITING-TREATMENT

A. Apply corrosion-inhibiting treatment to [**surfaces indicated on Drawings, from wall-to-wall or curb-to-curb and from joint-to-joint in the perpendicular direction**]<**Insert locations and extent where treatment shall be applied**>.

B. Apply by brush, roller, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before

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patching treated concrete[**or applying a sealer or overlay**].

3.13 APPLICATION OF POLYMER OVERLAY

A. Apply polymer overlay according to ACI 503.3.

B. Apply to traffic-bearing surfaces, including parking areas and walks.

3.14 APPLICATION OF POLYMER SEALER

A. Apply polymer sealer by brush, roller, or airless spray at manufacturer's recommended application rate.

B. Apply to traffic-bearing surfaces, including parking areas and walks.

3.15 INSTALLATION OF COMPOSITE STRUCTURAL REINFORCEMENT

A. Fiber Tow Sheet and Saturant: Unless otherwise recommended by manufacturer, install as follows:

1. Apply epoxy primer using brush or short nap roller to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
2. After primer has set, patch surface defects with epoxy filler and allow to set before beginning reinforcement application.
3. Apply epoxy saturant to [**fiber tow sheet**][**or**][**primed and patched surface**] using roller. Apply fiber tow sheet to primed and patched surface while saturant is still wet, using pressure roller to remove air pockets. Remove paper backing from fiber tow sheet and apply additional epoxy to fully saturate tow sheet.
4. Apply additional layers using same procedure, fully saturating each layer with epoxy.
5. After saturant has cured, apply protective topcoat by [**brush**][**roller**][**or**][**spray**].

B. Preimpregnated Fiber Sheet: Unless otherwise recommended by manufacturer, install as follows:

1. Patch surface defects with epoxy mortar and allow to set before beginning reinforcement application.
2. Apply epoxy adhesive to a thickness of 1/16 inch to prepared concrete surfaces.
3. Clean fiber sheet with acetone or other suitable solvent, and apply epoxy adhesive to a thickness of 1/16 inch.
4. Apply adhesive-coated fiber sheet to adhesive-coated concrete and roll with a hard rubber roller until fiber sheet is fully embedded in adhesive, air pockets are removed, and adhesive is forced out from beneath fiber sheet at edges.
5. Apply additional layers using same procedure.

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3.16 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner will engage**][**Engage**] a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Packaged, Cementitious Patching Mortar: <**Insert number**> randomly selected sets of samples for each type of mortar required, tested according to ASTM C928/C928M.
2. Job-Mixed Patching Mortar: <**Insert number**> randomly selected sets of samples for each type of mortar required, tested for compressive strength according to ASTM C109/C109M.
3. Concrete: As specified in [**Section 033000 "Cast-in-Place Concrete."**][**Section 033300 "Architectural Concrete."**]
4. Grout for Preplaced Aggregate: Tested for compressive strength according to ASTM C942.

    a. Testing Frequency: One sample for each 25 cu. yd. of grout or fraction thereof, but not less than one sample for each day's work.

5. Joint Filler: Core-drilled samples to verify proper installation.

    a. Testing Frequency: One sample for each 100 feet of joint filled.
    b. Where samples are taken, refill holes with joint filler.

6. Epoxy Crack Injection: Core-drilled samples to verify proper installation.

    a. Testing Frequency: [**Three samples from mockup and**]one sample for each 100 feet of crack injected.
    b. Where samples are taken, refill holes with epoxy mortar.

C. Product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Manufacturers Field Service: Engage manufacturers' factory-authorized service representatives for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.

1. Have manufacturers' factory-authorized service representatives perform the following number of Project-site inspections to observe progress and quality of the Work, distributed over the period of product installation, regardless of on-site assistance requested by Architect:

    a. Bonding-Agent and Packaged Patching-Mortar Installation: [**Three**]<**Insert number**> inspections.
    b. Joint-Filler Installation: [**Two**]<**Insert number**> inspections.
    c. Crack-Injection-Adhesive Preparation and Installation: [**Four**]<**Insert number**> inspections.
    d. Corrosion-Inhibiting Treatment: [**Two**]<**Insert number**> inspections.

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e. Polymer Overlay: [Two]<Insert number> inspections.
f. Polymer Sealer: [Two]<Insert number> inspections.
g. Composite-Structural-Reinforcement: [Three]<Insert number> inspections.

3.17 CONCRETE MAINTENANCE SCHEDULE

A. Garage Level 1 Entrance Ramp: Perform the following as indicated on Drawings:

1. Removal of deteriorated concrete and subsequent replacement and patching.
2. Floor joint repair.
3. Epoxy crack injection.
4. Corrosion-inhibiting treatment.
5. Polymer overlays.
6. Polymer sealers.
7. Composite structural reinforcement on underside of slab.

B. Elevated Warehouse Floors: Perform the following as indicated on Drawings:

1. Removal of deteriorated concrete and subsequent replacement and patching.
2. Floor joint repair.
3. Epoxy crack injection.
4. Corrosion-inhibiting treatment.
5. Polymer overlays.
6. Polymer sealers.
7. Composite structural reinforcement on underside of slab.

C. Concrete Walls and Floor in Salt Dome: Perform the following as indicated on Drawings:

1. Removal of deteriorated concrete and subsequent replacement and patching.
2. Floor joint repair.
3. Epoxy crack injection.
4. Corrosion-inhibiting treatment.
5. Polymer overlays.
6. Polymer sealers.
7. Composite structural reinforcement of columns.

END OF SECTION 030130

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SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:

1. Section 033816 "Unbonded Post-Tensioned Concrete" for reinforcing related to post-tensioned concrete.
2. Section 034100 "Precast Structural Concrete" for reinforcing used in precast structural concrete.
3. Section 034500 "Precast Architectural Concrete" for reinforcing used in precast architectural concrete.
4. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.
5. Section 321316 "Decorative Concrete Paving" for reinforcing related to decorative concrete pavement and walks.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction contraction and isolation joints.
c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Epoxy repair coating.
3. Zinc repair material.
4. Bar supports.
5. Mechanical splice couplers.

B. Sustainable Design Submittals:

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1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
2. Environmental Product Declaration: For each product.
3. Third-Party Certifications: For each product.
4. Third-Party Certified Life Cycle Assessment: For each product.

C. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.

D. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Architect.

E. Delegated Design Submittal: For structural thermal break insulated connection system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For [**delegated design engineer**][**testing and inspection agency**].

B. Delegated Design Engineer Qualifications: Include the following:

1. Experience providing delegated design engineering services of the type indicated.
2. Documentation that delegated design engineer is licensed in the [**jurisdiction**][**state**] in which Project is located.

C. Welding certificates.

1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.

D. Material Certificates: For each of the following, signed by manufacturers:

1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
2. Dual-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

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E. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

2. Mechanical splice couplers.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency,[**acceptable to authorities having jurisdiction,**] qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

C. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.

1. Build panel approximately [**100 sq. ft. for formed surface**]<**Insert area**> in the location indicated on Drawings or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design structural thermal break insulated connection system, including attachment to building construction.

B. Structural Performance of Structural Thermal Break Insulating Connection System: Structural thermal break insulated connection system to withstand the following loads and stresses:

1. Dead Loads: As indicated on Drawings.

a. Shear Load: As indicated on Drawings.
b. Bending Moment: As indicated on Drawings.

2. Live Loads: As indicated on Drawings.

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a. Shear Load: As indicated on Drawings.
b. Bending Moment: As indicated on Drawings.

C. Seismic Performance of Structural Thermal Break Insulated Connection System: Structural thermal break Insulated connection system to withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**]<**Insert requirement**>.

1. Component Importance Factor: <**Insert requirement**>.

PART 3 - EXECUTION

3.1 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install structural thermal break insulated connection system in accordance with manufacturer's instructions.

H. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.

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2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

I. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.

J. Dual-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.

K. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material in accordance with ASTM A780/A780M.

3.2 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a [special inspector][and][qualified testing and inspecting agency] to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement mechanical splice couplers.
3. Steel-reinforcement welding.

D. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.

END OF SECTION 032000

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.
4. Section 033543 "Polished Concrete Finishing" for concrete floors scheduled to receive a polished concrete finish.
5. Section 035300 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
6. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
7. Section 321313 "Concrete Paving" for concrete pavement and walks.
8. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.

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d. Concrete Subcontractor.
e. Special concrete finish Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Semirigid joint fillers.
d. Vapor-retarder installation.
e. Anchor rod and anchorage device installation tolerances.
f. Cold and hot weather concreting procedures.
g. Concrete finishes and finishing.
h. Curing procedures.
i. Forms and form-removal limitations.
j. Shoring and reshoring procedures.
k. Methods for achieving specified floor and slab flatness and levelness.
l. Floor and slab flatness and levelness measurements.
m. Concrete repair procedures.
n. Concrete protection.
o. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
p. Protection of field cured field test cylinders.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement
7. Aggregates.
8. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

9. Color pigments.
10. Fiber reinforcement.
11. Vapor retarders.
12. Floor and slab treatments.
13. Liquid floor treatments.
14. Curing materials.

a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment

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manufacturer.

15. Joint fillers.
16. Repair materials.

B. Sustainable Design Submittals:

1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
2. Environmental Product Declaration: For each product.
3. Third-Party Certifications: For each product.
4. Third-Party Certified Life Cycle Assessment: For each product.
5. Laboratory Test Reports: For [**liquid floor treatments**][**and**][**curing and sealing compounds**], indicating compliance with requirements for low-emitting materials.

C. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.
11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
13. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
14. Intended placement method.
15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

E. Samples: For [**manufacturer's standard colors for color pigment**][**vapor retarder**]<**Insert products**>.

F. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

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1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates.
8. Admixtures:

    a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Research Reports:

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1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

F. Preconstruction Test Reports: For each mix design.

G. Field quality-control reports.

H. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician [**with experience installing and finishing concrete, incorporating permeability-reducing admixtures**].

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality-Control Testing Agency Qualifications: An independent agency,[**acceptable to authorities having jurisdiction,**] qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

E. Mockups: Cast concrete [**slab-on-ground**][**and**][**formed-surface**] panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Slab-On-Ground: Build panel approximately **15 feet by 15 feet** <**Insert area**> in the location indicated or, if not indicated, as directed by Architect.

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a. Divide panel into four equal panels to demonstrate saw joint cutting.

2. Formed Surfaces: Build panel approximately 100 sq. ft. <Insert area> in the location indicated or, if not indicated, as directed by Architect.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.
f. Permeability.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

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1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Indigenous Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

B. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

C. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, [**Type I**][**Type II**][**Type I/II**][**Type III**][**Type V**], [**gray**][**white**].
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M, [**Type IS, portland blast-furnace slag**][**Type IP, portland-pozzolan**][**Type IL, portland-limestone**][**Type IT, ternary blended**] cement.
5. Silica Fume: ASTM C1240 amorphous silica.
6. Performance-Based Hydraulic Cement: ASTM C1157/C1157M: [**Type GU, general use**][**Type HE, high early strength**][**Type MS, moderate sulfate resistance**][**Type HS, high sulfate resistance**][**Type MH, moderate heat of hydration**][**Type LH, low heat of hydration**].

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D. Normal-Weight Aggregates: ASTM C33/C33M, [**Class 3S**][**Class 3M**][**Class 1N**]<**Insert class**> coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than **4 lb./cu. yd.** for moderately reactive aggregate or **3 lb./cu. yd.** for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with **ACI 301**.

2. Maximum Coarse-Aggregate Size: [**1-1/2 inches**][**1 inch**][**3/4 inch**]<**Insert dimension**> nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

E. Lightweight Aggregate: ASTM C330/C330M, [**1-inch**][**3/4-inch**][**1/2-inch**][**3/8-inch**] nominal maximum aggregate size.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable [**or**][**complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4**]

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A[**, except with maximum water-vapor permeance of**]<**Insert rating**>; not less than **10 mils** thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Barrier-Bac; Inteplast Group**]
b. [**Foxfire Enterprises, Inc.**]
c. [**ISI Building Products**]
d. [**Poly-America, L.P.**]
e. [**R&D Workshop**]
f. [**Reef Industries, Inc.**]
g. [**Stego Industries, LLC**]
h. [**Tex-Trude**]
i. [**Viaflex**]
j. [**W. R. Meadows, Inc**]
k. <**Insert manufacturer's name**>

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2.4 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than [4100 psi]<Insert strength> at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than [5000 psi]<Insert strength> at 28 days when tested in accordance with ASTM C109/C109M.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

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1. Use [**water-reducing**][**high-range water-reducing**][**or**][**plasticizing**] admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in [**pumped concrete,**][**concrete for heavy-use industrial slabs**][**concrete for parking structure slabs,**][**and**][**concrete with a w/cm below 0.50**].
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
5. Use permeability-reducing admixture in concrete mixtures where indicated.

D. Color: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.6 CONCRETE MIXTURES

A. Class [**A**]<**Insert designation**>: Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: ACI 318 [**F0**][**F1**][**F2**][**F3**][**S0**][**S1**][**S2**][**S3**][**W0**][**W1**][**C0**][**C1**][**C2**].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi][**As indicated**]<**Insert strength**> at 28 days.
3. Maximum w/cm: [**0.50**][**0.45**][**0.40**]<**Insert number**>.
4. Slump Limit: [4 inches, plus or minus 1 inch][5 inches, plus or minus 1 inch][8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inchbefore adding high-range water-reducing admixture or plasticizing admixture at Project site]<**Insert limits**>.
5. Slump Flow Limit: [22 inches, plus or minus 1.5 inches][30 inches, plus or minus 2.5 inches]<**Insert limits**>.
6. Air Content:

    a. Exposure Class F1: [**5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size**][**4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size**][**4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size**].
    b. Exposure Classes F2 and F3: [**6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size**][**6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size**][**5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size**].

7. Limit water-soluble, chloride-ion content in hardened concrete to [**1.00**][**0.30**][**0.15**]<**Insert number**> percent by weight of cement.

B. Class [**B**]<**Insert designation**>: Normal-weight concrete used for foundation walls.

1. Exposure Class: ACI 318 [**F0**][**F1**][**F2**][**F3**][**S0**][**S1**][**S2**][**S3**][**W0**][**W1**][**C0**][**C1**][**C2**].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000

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psi][As indicated]<Insert strength> at 28 days.

3. Maximum w/cm: [0.50][0.45][0.40]<Insert number>.
4. Slump Limit: [4 inches, plus or minus 1 inch][5 inches, plus or minus 1 inch][8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches, plus or minus 1 inch, before adding high-range water-reducing admixture or plasticizing admixture at Project site]<Insert limits>.
5. Slump Flow Limit: [22 inches, plus or minus 1.5 inches][30 inches, plus or minus 2.5 inches]<Insert limits>.
6. Air Content:

    a. Exposure Class F1: [5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].
    b. Exposure Classes F2 and F3: [6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].

7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.

C. Class [C]<Insert designation>: Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 [F0][S0][S1][S2][S3][W0][W1][C0][C1][C2].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi][As indicated]<Insert strength> at 28 days.
3. Maximum w/cm: [0.50][0.45][0.40]<Insert number>.
4. Minimum Cementitious Materials Content: [470 lb/cu. yd.][520 lb/cu. yd.][540 lb/cu. yd.][610 lb/cu. yd.].
5. Slump Limit: [4 inches, plus or minus 1 inch][5 inches, plus or minus 1 inch][8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches, plus or minus 1 inch, before adding high-range water-reducing admixture or plasticizing admixture at Project site]<Insert limits>.
6. Slump Flow Limit: [22 inches, plus or minus 1.5 inches][30 inches, plus or minus 2.5 inches]<Insert limits>.
7. Air Content:

    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

8. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.
9. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of [50 lb/cu. yd.]<Insert weight>.

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10. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [1.0 lb/cu. yd.][1.5 lb/cu. yd.]<Insert dosage>.
11. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [4.0 lb/cu. yd.][5 lb/cu. yd.]<Insert dosage>.

D. Class [D]<Insert designation>: Normal-weight concrete used for interior suspended slabs.

1. Exposure Class: ACI 318 [F0][S0][S1][S2][S3][W0][W1][C0][C1][C2].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi]<Insert strength>[As indicated] at 28 days.
3. Maximum w/cm: [0.50][0.45][0.40]<Insert number>.
4. Minimum Cementitious Materials Content: [470 lb/cu. yd.][520 lb/cu. yd.][540 lb/cu. yd.][610 lb/cu. yd.].
5. Slump Limit: [4 inches, plus or minus 1 inch][5 inches, plus or minus 1 inch][8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches, plus or minus 1 inch, before adding high-range water-reducing admixture or plasticizing admixture at Project site]<Insert limits>.
6. Slump Flow Limit: [22 inches, plus or minus 1.5 inches][30 inches, plus or minus 2.5 inches]<Insert limits>.
7. Air Content:

    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

8. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.
9. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of [50 lb/cu. yd.]<Insert weight>.
10. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [1.0 lb/cu. yd.][1.5 lb/cu. yd.]<Insert dosage>.
11. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [4.0 lb/cu. yd.][5 lb/cu. yd.]<Insert dosage>.

E. Class [E]<Insert designation>: Structural lightweight concrete used for interior suspended slabs.

1. Exposure Class: ACI 318 [F0][S0][S1][S2][S3][W0][W1][C0][C1][C2].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi]<Insert strength>[As indicated] at 28 days.
3. Calculated Equilibrium Unit Weight: [115 lb/cu. ft.][110 lb/cu. ft.][105 lb/cu. ft.], plus or minus 3 lb/cu. ft. as determined by ASTM C567/C567M.
4. Slump Limit: [4 inches, plus or minus 1 inch][5 inches, plus or minus 1 inch][8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches, plus or minus 1 inch, before adding high-range water-reducing admixture or plasticizing admixture at Project site]<Insert limits>.

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5. Slump Flow Limit: [22 inches, plus or minus 1.5 inches][30 inches, plus or minus 2.5 inches]<Insert limits>.
6. Air Content:

    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.
8. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of [50 lb/cu. yd.]<Insert weight>.
9. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [1.0 lb/cu. yd.][1.5 lb/cu. yd.]<Insert dosage>.
10. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [4.0 lb/cu. yd.][5 lb/cu. yd.]<Insert dosage>.

F. Class [F]<Insert designation>: Normal-weight concrete used for concrete toppings.

1. Exposure Class: ACI 318 [F0][F1][F2][F3][S0][S1][S2][S3][W0][W1][C0][C1][C2].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi]<Insert strength>[As indicated] at 28 days.
3. Minimum Cementitious Materials Content: [470 lb/cu. yd.][520 lb/cu. yd.][540 lb/cu. yd.].
4. Slump Limit: [4 inches][5 inches], plus or minus 1 inch.
5. Air Content:

    a. Exposure Class F1: [5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].
    b. Exposure Classes F2 and F3: [6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].

6. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.

    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished toppings.

7. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of [50 lb/cu. yd.]<Insert weight>.
8. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's

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recommended rate, but not less than a rate of [1.0 lb/cu. yd.][1.5 lb/cu. yd.]<Insert dosage>.

9. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [4.0 lb/cu. yd.][5 lb/cu. yd.]<Insert dosage>.

G. Class [G]<Insert designation>: Normal-weight concrete used for building frame members.

1. Exposure Class: ACI 318 [F0][F1][F2][F3][S0][S1][S2][S3][W0][W1][C0][C1][C2].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi]<Insert strength>[As indicated] at 28 days.
3. Maximum w/cm: [0.50][0.45][0.40]<Insert number>.
4. Slump Limit: [4 inches, plus or minus 1 inch][5 inches, plus or minus 1 inch][8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches, plus or minus 1 inch, before adding high-range water-reducing admixture or plasticizing admixture at Project site]<Insert limits>.
5. Slump Flow Limit: [22 inches, plus or minus 1.5 inches][30 inches, plus or minus 2.5 inches]<Insert limits>.
6. Air Content:

    a. Exposure Class F1: [5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].
    b. Exposure Classes F2 and F3: [6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].

7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.

H. Class [H]<Insert designation>: Normal-weight concrete used for building walls.

1. Exposure Class: ACI 318 [F0][F1][F2][F3][S0][S1][S2][S3][W0][W1][C0][C1][C2].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi]<Insert strength>[As indicated] at 28 days.
3. Maximum w/cm: [0.50][0.45][0.40]<Insert number>.
4. Slump Limit: [4 inches, plus or minus 1 inch][5 inches, plus or minus 1 inch][8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches, plus or minus 1 inch, before adding high-range water-reducing admixture or plasticizing admixture at Project site]<Insert limits>.
5. Slump Flow Limit: [22 inches, plus or minus 1.5 inches][30 inches, plus or minus 2.5 inches]<Insert limits>.
6. Air Content:

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a. Exposure Class F1: [5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].
b. Exposure Classes F2 and F3: [6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].

7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.

I. Class [I]<Insert designation>: Normal-weight concrete used for interior metal pan stairs and landings:

1. Exposure Class: ACI 318 [F0][F1][F2][F3][S0][S1][S2][S3][W0][W1][C0][C1][C2].
2. Minimum Compressive Strength: [3000 psi]<Insert strength>[As indicated] at 28 days.
3. Maximum w/cm: [0.53][0.45][0.40]<Insert number>.
4. Minimum Cementitious Materials Content: 470 lb/cu. yd..
5. Maximum Size Aggregate: 1/2 inch.
6. Slump Limit: 3 inches, plus 1 inch or minus 2 inches.
7. Air Content: [0]<Insert number> percent, plus or minus 0.5 percent at point of delivery.
8. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.
9. Retarding Admixture: Not allowed.
10. Accelerating Admixture: Not allowed.

J. Class [J]<Insert designation>: Normal-weight concrete used for exterior retaining walls.

1. Exposure Class: ACI 318 [F0][F1][F2][F3][S0][S1][S2][S3][W0][W1][C0][C1][C2].
2. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi]<Insert strength>[As indicated] at 28 days.
3. Maximum w/cm: [0.50][0.45][0.40]<Insert number>.
4. Slump Limit: [4 inches, plus or minus 1 inch][5 inches, plus or minus 1 inch][8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches, plus or minus 1 inch, before adding high-range water-reducing admixture or plasticizing admixture at Project site]<Insert limits>.
5. Slump Flow Limit: [22 inches, plus or minus 1.5 inches][30 inches, plus or minus 2.5 inches]<Insert limits>.
6. Air Content:

a. Exposure Class F1: [5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete

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containing 1-inch nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].

b. Exposure Classes F2 and F3: [6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size][6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size].

7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15]<Insert number> percent by weight of cement.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M[and ASTM C1116/C1116M], and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

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1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

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B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls [**as indicated on Drawings**]<**Insert spacing**>. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least [**one-fourth**]<**Insert depth**> of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

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E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.

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c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
b. Remove projections larger than 1 inch.
c. Tie holes do not require patching.
d. Surface Tolerance: ACI 117 Class D.
e. Apply to concrete surfaces [**not exposed to public view**]<**Insert locations**>.

2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
b. Remove projections larger than 1/4 inch.
c. Patch tie holes.
d. Surface Tolerance: ACI 117 Class B.
e. Locations: Apply to concrete surfaces [**exposed to public view,**][**to receive a rubbed finish,**][**or to be covered with a coating or covering material applied directly to concrete**]<**Insert locations**>.

3. ACI 301 Surface Finish SF-3.0:

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
b. Remove projections larger than 1/8 inch.
c. Patch tie holes.

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d. Surface Tolerance: ACI 117 Class A.
e. Locations: Apply to concrete surfaces [**exposed to public view,**][**to receive a rubbed finish,**][**or to be covered with a coating or covering material applied directly to concrete**]<**Insert locations**>.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:

a. Perform no later than one day after form removal.
b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
d. Maintain required patterns or variances as shown on Drawings or to match [**design reference sample**][**field sample panels**][**mockups**].

2. Grout-Cleaned Rubbed Finish:

a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
b. Do not clean concrete surfaces as Work progresses.
c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
d. Wet concrete surfaces.
e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
f. Maintain required patterns or variances as shown on Drawings or to match [**design reference sample**][**field sample panels**][**mockups**].

3. Cork-Floated Finish:

a. Mix 1 part portland cement to 1 part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
b. Mix 1 part portland cement and 1 part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
c. Wet concrete surfaces.
d. Compress grout into voids by grinding surface.
e. In a swirling motion, finish surface with a cork float.
f. Maintain required patterns or variances as shown on Drawings or to match [**design reference sample**][**field sample panels**][**mockups**].

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4. Scrubbed Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi, apply scrubbed finish.

    a. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed.
    b. Rinse scrubbed surfaces with clean water.
    c. Maintain continuity of finish on each surface or area of Work.
    d. Remove only enough concrete mortar from surfaces to match [**design reference sample**][**field sample panels**][**mockups**].

C. Abrasive-Blast Finish: Apply the following to as-cast surface finishes where indicated on Drawings:

1. Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi.
2. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at the same age.
3. Surface Continuity:

    a. Perform abrasive-blast finishing as continuous operation, maintaining continuity of finish on each surface or area of Work.
    b. Maintain required patterns or variances in depths of blast to match [**design reference sample**][**field sample panels**][**mockups**].

4. Abrasive Blasting:

    a. Abrasive-blast corners and edges of patterns carefully, using backup boards to maintain uniform corner and edge lines.
    b. Determine type of nozzle pressure and blasting techniques required to match field sample.
    c. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces to match field sample, as follows:

        1) Brush Texture: Remove cement matrix to dull surface sheen and expose face of fine aggregate, with no significant reveal.
        2) Light Texture: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color, with maximum reveal of 1/16 inch.
        3) Medium Texture: Generally, expose coarse aggregate with slight reveal and with a maximum reveal of 1/4 inch.
        4) Heavy Texture: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter, with reveal range of 1/4 to 1/2 inch.

    d. Maintain required patterns or variances in reveal projection to match [**design reference sample**][**field sample panels**][**mockups**].

D. High-Pressure Water-Jet Finish: Apply the following to as-cast surface finishes where indicated on Drawings:

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1. Perform high-pressure water jetting on concrete that has achieved a minimum compressive strength of 4500 psi.
2. Coordinate with formwork removal to ensure that surfaces to be high-pressure water-jet finished are treated at same age for uniform results.
3. Surface Continuity: Perform high-pressure water-jet finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.
4. Maintain required patterns or variances in reveal projection to match [**design reference sample**][**field sample panels**][**mockups**].

E. Bushhammer Finish: Apply the following to as-cast surface finishes where indicated on Drawings:

1. Perform bushhammer finish to concrete that has achieved a minimum compressive strength of 4500 psi.
2. Surface Continuity:

    a. Perform bushhammer finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.

3. Surface Cut:

    a. Maintain required depth of cut and general aggregate exposure.
    b. Use power tool with hammer attachments for large, flat surfaces, and use hand hammers for small areas, at corners and edges, and for restricted locations where power tools cannot reach.

4. Remove impressions of formwork and form facings with exception of tie holes.
5. Maintain required patterns or variances of cut as shown on Drawings or to match [**design reference sample**][**field sample panels**][**mockups**].
6. Maintain control of concrete chips, dust, and debris in each Work area, limiting migration of airborne materials and dust by use of tarpaulins, wind-breaks, or similar devices.

F. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-

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floated or darbied.

2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces [**to receive concrete floor toppings**][**to receive mortar setting beds for bonded cementitious floor finishes**]<**Insert locations**>.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces [**to receive trowel finish**][**and**][**to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo**]<**Insert locations**>.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces [**exposed to view**][**or**][**to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system**]<**Insert locations**>.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed [1/4 inch][3/16 inch][1/8 inch][1/8 inch **and also no more than** 1/16 inch **in**2 feet].
        2) Specified overall values of flatness, FF 25; and of levelness, FL 20; with minimum local values of flatness, FF 17; and of levelness, FL 15.
        3) Specified overall values of flatness, FF 35; and of levelness, FL 25; with minimum local values of flatness, FF 24; and of levelness, FL 17.
        4) Specified overall values of flatness, FF 45; and of levelness, FL 35;

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with minimum local values of flatness, FF 30; and of levelness, FL 24.

5) Specified overall values of flatness, FF 50; and of levelness, FL 25; with minimum local values of flatness, FF 40; and of levelness, FL 17.

b. Suspended Slabs:

1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed [1/4 inch][3/16 inch][1/8 inch][1/8 inch **and also no more than** 1/16 inch **in** 2 feet].
2) Specified overall values of flatness, FF 25; and of levelness, FL 20; with minimum local values of flatness, FF 17; and of levelness, FL 15.
3) Specified overall values of flatness, FF 35; and of levelness, FL 20; with minimum local values of flatness, FF 24; and of levelness, FL 15.
4) Specified overall values of flatness, FF 45; and of levelness, FL 35; with minimum local values of flatness, FF 30; and of levelness, FL 24.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces [**indicated on Drawings**][**where ceramic or quarry tile is to be installed by either thickset or thinset method**]. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive [**aggregate**][**aluminum granule**] finish to concrete stair treads, platforms, ramps as indicated on Drawings

1. Apply in accordance with manufacturer's written instructions and as follows:

a. Uniformly spread [25 lb/100 sq. ft.]<**Insert rate**> of dampened slip-resistive [**aggregate**][**aluminum granules**] over surface in one or two applications.
b. Tamp aggregate flush with surface, but do not force below surface.
c. After broadcasting and tamping, apply float finish.
d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive [**aggregate**][**aluminum granules**].

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener

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to surfaces in accordance with manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of [100 lb/100 sq. ft.]<Insert rate> unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating.
3. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
4. After final floating, apply a trowel finish.
5. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases [4 inches][6 inches][8 inches]<Insert dimension> high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: [5000 psi][4500 psi][4000 psi][3500 psi][3000 psi]<Insert value> at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

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D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
b. Continuous Sprinkling: Maintain concrete surface continuously wet.
c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

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1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12 inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.
   b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12 inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.

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b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing

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period.

4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer[**unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project**].

g. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least [**one**][**six**] month(s).
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

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C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane,

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and level surface.

b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

   a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
   b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
   c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
   d. Place, compact, and finish to blend with adjacent finished concrete.
   e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.
   c. Place patching mortar before bonding agent has dried.
   d. Compact patching mortar and finish to match adjacent concrete.
   e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: [**Owner will engage**][**Engage**] a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.

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2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for

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each additional 50 cu. yd. or fraction thereof.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; [**ASTM C173/C173M volumetric method, for structural lightweight concrete**].

a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C31/C31M:

a. Cast and laboratory cure two sets of [**two**][**three**][**four**] 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
b. Cast, initial cure, and field cure [**two**]<**Insert number**> sets of [**two**][**three**][**four**] standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39/C39M.

a. Test one set of [**two**][**three**][**four**] laboratory-cured specimens at seven days and one set of two specimens at 28 days.
b. Test one set of [**two**][**three**][**four**] field-cured specimens at seven days and one set of two specimens at 28 days.
c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

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9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within [24][48][72]<Insert number> hours of completion of floor finishing and promptly report test results to Architect.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

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END OF SECTION 033000

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SECTION 040110 - MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleaning materials.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to cleaning masonry, including, but not limited to, the following:

a. Scheduling a pre-mockup meeting.
b. Manufacturer's representative of cleaning materials to be present during testing for consultation.
c. Mockup locations.
d. Masonry types.
e. Soiling types.
f. Verify masonry-cleaning equipment and facilities needed to make progress and avoid delays.
g. Materials, material application, and sequencing.
h. Cleaning types and cleaning methods.
i. Quality-control program.
j. Review cleaning program.
k. Coordination with building occupants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions and application instructions.
2. Include test data substantiating that products comply with requirements.

B. Material certificates signed by manufacturer and Contractor certifying that each material complies with requirements.

C. Each type of chemical cleaning material.

D. Qualification data for firms and specialists to demonstrate their capabilities and experience. Include list of five completed projects with project names and references.

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E. Cleaning Program:

1. Describe cleaning protocol, materials, methods, and equipment to be used.
2. Indicate protection of surrounding materials on people, vehicles, buildings, and site items.
3. Describe control method of runoff during operations.
4. Create written report of final cleaning methods and process used.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For chemical-cleaner manufacturer.

B. Preconstruction Test Reports: For cleaning materials and methods.

C. Cleaning program.

1.5 QUALITY ASSURANCE

A. Source of Materials: Obtain materials for masonry cleaning from a single source for each type of substrate required to ensure quality of cleaning.

B. Paint-Remover Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, who employs factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.

C. Masonry-Cleaning Specialist Firms: A firm that provides masonry cleaning, including masonry cleaners that have been used for similar applications with successful results, and is manufacturer authorized for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.

D. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, who employs factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.

E. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

F. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used; protection of surrounding materials; and control of runoff during operations. Include provisions for supervising worker performance and preventing damage.

1. If materials and methods other than those indicated are proposed for any phase

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of cleaning Work, add a written description of such materials and methods, including evidence of successful use on comparable projects and demonstrations to show their effectiveness for this Project.

1.6 MOCKUPS

A. Prepare mockups of cleaning on existing surfaces to evaluate and establish cleaning materials and processes. Consult cleaning manufacturer for project applications.

1. Masonry Substrate: Clay masonry Concrete masonry units.
2. Cleaning: Clean an existing area as indicated in elevations for each type of masonry and surface condition.

    a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
    b. Consult with chemical cleaning product manufacturer to verify what products require pre-wetting of substrate before cleaner application.
    c. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.
    d. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage one or more chemical-cleaner[**and paint-remover**] manufacturers to perform preconstruction testing on masonry surfaces.

1. Use test areas as indicated and representative of proposed materials and existing construction.
2. Propose changes to materials and methods to suit Project.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry-cleaning Work to be performed in accordance with product manufacturers' written instructions and specified requirements.

B. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least seven days after completion of cleaning.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has thawed and dried out, but not less than seven days after completion of cleaning.

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2. Hot-Weather Requirements: Protect unit masonry Work when temperature and humidity conditions produce excessive evaporation of water from masonry. Provide artificial shade and wind breaks and use cooled materials as required.

C. Refer to chemical cleaner manufacturer's recommendations for application techniques when hot-weather conditions exist.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

E. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**American Building Restoration Products, Inc.**]
b. [**Cathedral Stone Products, Inc.**]
c. [**Diedrich Technologies, Inc.; a Hohmann & Barnard company**]
d. [**Dumond Chemicals, Inc**]
e. [**Hydroclean; Hydrochemical Techniques, Inc**]
f. [**Price Research, Ltd. dba Charles Paint Research**]
g. [**PROSOCO, Inc**]
h. <**Insert manufacturer's name**>

2. Masonry Substrate: [**Clay masonry**][**Glazed masonry**][**Marble**][**Concrete masonry units**][**Stone veneer**][**Terra cotta**][**Glazed terra cotta**][**Slate**][**Stone**][**Limestone**][**Sandstone**][**Granite**][**Polished granite**][**Travertine**].

F. Poultices Cleaners: Manufacturer's temporary cleaning coating designed to remove dirt and stains without water in its application or removal. Consult manufacturer for strength level to fit project masonry substrates.

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1. <Insert manufacturer's name; product name or designation>.
2. Masonry Substrate: [Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].

2.2 ACCESSORY MATERIALS

A. Retain materials of use based on the approval of a mockup.

1. Provide materials with previous effectiveness in performing the Work involved.

a. Include materials with minimal possibility of damaging exposed surfaces.
b. Materials with consistency of each application.
c. Materials that provide uniformity of the resulting overall appearance.

B. Do not use products or tools that could do the following:

1. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces.
2. Leave residue on surfaces.

C. Equipment: Provide equipment for controlled spray application of water and chemical cleaners.

1. For chemical cleaner spray applications, provide a low-pressure tank or chemical pump suitable for the chemical cleaner indicated, equipped with spray tip for cleaning method applications.

D. Natural bristles brushes only.

E. Wood scrappers.

F. Trowels.

G. Provide additional accessories applicable to project conditions, including tapes, sheets, etc., to suit Project.

PART 3 - EXECUTION

3.1 APPLICATION OF PRELIMINARY CLEANING MATERIALS

A. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods.

1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
2. Removing Biological Growth: Completely remove visible biological, moss, and shrub growth from masonry surfaces. Carefully remove biological growths,

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creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and biological debris from open joints to whatever depth they occur.

3. Mold, Mildew, and Algae Removal:

    a. Wet surface with [cold][hot] water applied by low-pressure spray.
    b. Apply mold, mildew, and algae remover by brush[or low-pressure spray].
    c. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
    d. Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove mold, mildew, and algae remover and soil.

B. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

3.2 APPLICATION OF PAINT REMOVER

A. Paint-Remover Application, General: Apply paint removers in accordance with paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

B. Paint Removal with Alkaline Paste Paint Remover: .

1. Remove loose and peeling paint using [low][medium][high]-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with brushes.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove chemicals and paint residue.
5. Repeat process if necessary to remove all paint.
6. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
7. Rinse with cold water applied by [low][medium][high]-pressure spray to remove chemicals and soil.
8. Remove asphalt and tar with [solvent-type paste paint remover]<Insert requirement>.

    a. Apply paint remover only to asphalt and tar by brush without prewetting.
    b. Allow paint remover to remain on surface for 10 to 30 minutes.
    c. Repeat application if needed.

C. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover: .

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1. Remove loose and peeling paint using [low][medium][high]-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with trowel, spatula, or as recommended in writing by manufacturer.
3. Apply cover in accordance with manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
5. Scrape off paint and remover.
6. Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove chemicals and paint residue.
7. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
8. Rinse with cold water applied by [low][medium][high]-pressure spray to remove chemicals and soil.

D. Paint Removal with Solvent-Type Paste Paint Remover: .

1. Remove loose and peeling paint using [low][medium][high]-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply thick coating of paint remover to painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush. Apply in one or two coats in accordance with manufacturer's written instructions.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove chemicals and paint residue.

E. Paint Removal with Covered, Solvent-Type Paste Paint Remover: .

1. Remove loose and peeling paint using [low][medium][high]-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with trowel, spatula, or as recommended in writing by manufacturer.
3. Apply cover in accordance with manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
5. Scrape off paint and remover.
6. Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove chemicals and paint residue.

F. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

3.3 GENERAL APPLICATION OF CLEANING METHODS

A. Chemical Cleaning: Do not apply during winds of enough force to spread them to unprotected surfaces.

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B. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from [20 ft.][50 ft.]<Insert distance> away by Architect.

C. Proceed with cleaning in an orderly manner; work from [bottom to top][top to bottom] of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

D. Use only those cleaning methods indicated for each masonry material and location.

1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.

    a. Equip units with pressure gages.
    b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
    c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
    d. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
    e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
    f. For steam application, use steam generator capable of delivering live steam at nozzle.

E. Poultices: Where needed, provide a paste or slurry made with absorbent material or powder-inert clay, such as kaolin or sepiolite, diatomaceous earth (fuller's earth), or cellulose products such as pulp cellulose or shredded paper that is mixed with a cleaning solution (a liquid reagent such as water, organic solvent, among others).

F. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.

G. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed in accordance with "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.

H. Remove minor stains (cuprous, ferrous, etc.) if any.

I. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

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3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage[**paint-remover manufacturer's and**] chemical-cleaner manufacturer's factory-authorized service representatives for consultation and Project-site inspection, to perform preconstruction product testing, and provide on-site assistance when requested by Architect. Have[**paint-remover manufacturer's and**] chemical-cleaner manufacturer's factory-authorized service representatives visit Project site not less than [**once**][**twice**]<**Insert requirement**> to observing progress and quality of the work.

END OF SECTION 040110

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SECTION 050170.61 - DECORATIVE METAL REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative metal repairs as follows:

   a. Repairing metal and replacing damaged and missing components in place.
   b. Removing metal for shop repair and replacement of components; reinstalling repaired metal.
   c. Painting steel uncovered during the Work.

B. Related Requirements:

1. Section 013516 "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.
2. Section 057000 "Decorative Metal" for new decorative metal construction.
3. Section 057300 "Decorative Metal Railings" for new decorative handrails and railings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for product application and use.
2. Include test data substantiating that products comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, methods of attachment, accessory items, and finishes.
2. Include field-verified dimensions and the following:

   a. Identification of each new metal item and component and its location on the structure in annotated plans and elevations.
   b. Provisions for expansion, weep holes, and conduits as required for each location and exposure.
   c. Provisions for sealant joints if required.

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C. Samples for Initial Selection: For the following:

1. Each type of decorative metal item and component with applied finishes.
2. Sealant materials.
3. Accessories to verify color selection.

D. Samples for Verification: For the following products in manufacturer's standard sizes unless otherwise indicated, finished as required for use in the Work:

1. Each type of new material to be used for replacing existing or missing decorative metal; 6 inches long in least dimension or whole item.
2. Fittings and brackets.
3. Each type of exposed connection between components. Show method of finishing components at connections.
4. Each type of exposed finish prepared on metal of the same alloy to be used for the Work of this Section; 6 inches long in least dimension.
5. Sealant materials.
6. Accessories: Each type of anchor, accessory, and miscellaneous support in required finishes.

E. Delegated-Design Submittal: For [**structural performance of repaired railings, handrails, and anchors**]<**Insert item**>, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For decorative metal repair specialist.

B. Evaluation Reports: For post-installed structural anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Decorative Metal Repair Specialist Qualifications: A qualified decorative metal fabrication and repair specialist. Experience installing and finishing new decorative metalwork is insufficient experience for repairing decorative metal.

1. Single Specialist: Subject to compliance with requirements, engage the same specialist firm to perform the work of [**Section 050170.51 "Decorative Metal Cleaning"**][**Section 050170.63 "Decorative Metal Refinishing"**] and the work of this Section.

B. Mockups: Prepare mockups of decorative metal repair processes[**on existing surfaces**] to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation. Prepare mockups so they are inconspicuous.

1. Replacing Cast-Metal Components: [**Two**]<**Insert number**> cast-iron [**handrail brackets**][**and**][**grilles**]<**Insert item description**> replaced with exact duplicates.
2. Replacing Cut-Out Metal Items: [**Two**]<**Insert number**> cut-out bronze-plate [**wall**

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registers]<Insert item description> replaced with exact duplicates.

3. Repairing Wrought Handrail and Railing: [3 feet]<Insert dimension> of wrought-iron handrail and railing. [Patch indentations and reconnect fractures by filling, welding, brazing, or applying new metal material]<Insert description>.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Weather Limitations: Proceed with decorative metal repairs only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design post-installed structural anchors.

B. Structural Performance: [Railings][and][handrails]<Insert item>, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform load of 50 lbf/ft. applied in any direction.
2. Concentrated load of 200 lbf applied in any direction.
3. Uniform and concentrated loads need not be assumed to act concurrently.

2.2 METAL MATERIALS

A. General: Provide decorative metal materials made of the alloys, forms, and types that match existing metals and have the ability to receive finishes matching existing finishes unless otherwise indicated. Exposed-to-view surfaces exhibiting imperfections inconsistent with existing materials are unacceptable.

B. Source Limitation for Replacement Cast Materials: Obtain castings for decorative metal repair from single source from single manufacturer with resources to provide materials of consistent quality in appearance and physical properties.

C. Aluminum: Alloy and temper recommended in writing by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required:

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1. Extruded Bars and Shapes: ASTM B221, Alloy 6063-T6.
2. Extruded Structural Pipe and Tubes: ASTM B429/B429M, Alloy 6063-T6.
3. Drawn General-Purpose Seamless Tubes: ASTM B210, Alloy 6063-T832.
4. Plate and Sheet: ASTM B209, Alloy 6061-T6.
5. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.
6. Castings: ASTM B26/B26M, Alloy A356-T6.

D. Copper Alloys, Bronze: Copper alloy designated below for each form required:

1. Extruded Shapes: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze, 57 percent copper and 40 percent zinc).
2. Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper and 40 percent zinc).
3. Seamless Pipe: ASTM B43, Alloy UNS No. C23000 (red brass, 85 percent copper and 15 percent zinc).
4. Seamless Tubes: ASTM B135, Alloy UNS No. C23000 (red brass, 85 percent copper and 15 percent zinc).
5. Composition Bronze Castings: ASTM B62, Alloy UNS No. C83600 ("85-5-5-5" is the common trade name; 85 percent copper and 5 percent each of tin, lead, and zinc).
6. Sand Castings: ASTM B584, Alloy UNS No. C86500 (No. 1 manganese bronze, 58 percent copper, 39 percent zinc, 1 percent manganese, and small amounts of other metals).

E. Copper Alloys, Brass: Copper alloy designated below for each form required:

1. Extruded Shapes: ASTM B249/B249M, Alloy UNS No. C36000 (free-cutting brass, 60 percent copper, 36 percent zinc, and small amounts of other metals).
2. Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper and 30 percent zinc).
3. Seamless Tubes: ASTM B135, Alloy UNS No. C26000 (cartridge brass, 70 percent copper and 30 percent zinc).
4. Sand Castings: ASTM B584, Alloy UNS No. C85200 (high-copper yellow brass, 72 percent copper, 24 percent zinc, and small amounts of other metals).

F. Stainless Steel: Grade designated below for each form required:

1. Tubing: ASTM A554, [**Grade MT-304**][**Grade MT-316**].
2. Pipe: ASTM A312/A312M, [**Grade TP304**][**Grade TP316**].
3. Castings: ASTM A743/A743M, [**Grade CF8 or CF20**][**Grade CF8M**].
4. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, [**Type 304**][**Type 316**].
5. Flat Bar: ASTM A666, [**Type 304**][**Type 316**].
6. Bars and Shapes: ASTM A276, [**Type 304**][**Type 316**].

G. Steel: Standard and grade designated below for each form required:

1. Tubing: Cold formed, ASTM A500/A500M.
2. Steel Plate, Shapes, and Bars: ASTM A36/A36M.
3. Steel Bars: Mild steel; ASTM A29/A29M, Grade 1010.

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4. Steel Sheet: ASTM A1008/A1008M, cold-rolled commercial steel sheet; matte finish; suitable for exposed applications.

H. Cast Iron: Standard designated below for each type of casting:

1. Gray-Iron Castings: ASTM A48/A48M, Class 30.
2. Malleable-Iron Castings: ASTM A47/A47M, grade as recommended in writing by fabricator for type of use indicated.

I. Wrought Iron: [**Mild steel; ASTM A29/A29M, Grade 1010**]<**Insert requirement**>; hand worked or machine forged to the form indicated.

2.3 PREPARATORY CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

D. Abrasive Materials:

1. Abrasive Pads for Copper-Alloy Cleaning: Extra-fine bronze wool or plastic abrasive pads.
2. Blasting Abrasive: [**Pulverized walnut shells**][**Powdered aluminum silicate**]<**Insert material**>.
3. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.

E. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

F. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to [**MPI #23 (surface-tolerant, anticorrosive metal primer)**][or][**SSPC-Paint 20 or SSPC-Paint 29**]<**Insert requirement**>.

1. Surface Preparation: Use coating requiring no better than [**SSPC-SP 2, "Hand Tool Cleaning"**][**SSPC-SP 3, "Power Tool Cleaning"**][or][**SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning"**]<**Insert surface preparation standard**> surface preparation according to manufacturer's literature or certified statement.
2. VOC Limit: Use coating with a VOC content of [400 g/L]<**Insert VOC limit**> or less.

2.4 FINISHES, GENERAL

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, [**Class I, 0.018 mm**][**Class II, 0.010 mm**] or thicker over a [**satin (directionally textured)**][**polished (buffed)**][**nonspecular as fabricated**]<**Insert requirement**> mechanical finish.

C. Color Anodic Finish: AAMA 611, [**Class I, 0.018 mm**][**Class II, 0.010 mm**] or thicker over a [**satin (directionally textured)**][**polished (buffed)**][**nonspecular as fabricated**]<**Insert requirement**> mechanical finish.

D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

2.6 COPPER-ALLOY FINISHES

A. General: Finish designations for copper alloys comply with the system defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)."

B. Buffed Finish: [**M21 (Mechanical Finish: buffed, smooth specular)**][**M22 (Mechanical Finish: buffed, specular)**]<**Insert description**>.

C. Buffed Finish, Lacquered: [**M22 (Mechanical Finish: buffed, specular; specified clear organic coating)**]<**Insert description**>.

D. Satin Hand-Rubbed Finish: [**M32-M34 (Mechanical Finish: directionally textured, medium satin and hand rubbed)**]<**Insert description**>.

E. Satin Hand-Rubbed Finish, Lacquered: [**M32-M34-06x (Mechanical Finish: directionally textured, medium satin and hand rubbed; specified clear organic coating)**]<**Insert description**>.

F. Satin Finish with Statuary Conversion Coating: [**M32-C55 (directionally textured, medium satin; sulfide conversion coating)**]<**Insert description**>.

1. Color: [**Match design reference sample**][**Match existing**][**Match Architect's sample**]<**Insert color**>.

G. Brushed Finish with Patina Conversion Coating: M35-C12-C52 (directionally textured, rotary brushed and buff polished, nonetched cleaned; ammonium sulfate conversion coating).

1. Texture and Color: [**Match design reference sample**][**Match existing**][**Match**

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Architect's sample]<Insert description>.

H. Bright-Relieved Statuary Conversion Coating, Lacquered: M12-C55-M2x-06x (matte finish as cast; sulfide conversion coating; buffed to brighten high spots; specified clear organic coating):

1. Color and Buffing: [Match design reference sample][Match existing][Match Architect's sample]<Insert description>.

I. <Insert name> Patina Finish: <Insert description>.

2.7 FERROUS METAL FINISHES

A. Repair Primer: Manufacturer's standard, rust-inhibiting, fast-curing, lead- and chromate-free universal primer, compatible with[firmly adhered existing paint and] applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

B. Finish Primer: Primer complying with applicable requirements in [Section 090190.52 "Maintenance Repainting"]<Insert Section number and title> for finish painting of primed existing metal.

C. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

D. Patina Finish: <Insert description>.

2.8 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines from new replacement stainless steel, or blend into finish.

B. Restored Finish: Grind and polish surfaces to produce uniform, directionally textured, polished finish to match [existing finish][Architect's sample], free of cross scratches.

1. Run grain to match existing metal.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: ASTM A480/A480M, No. 4.
4. Dull Satin Finish: ASTM A480/A480M, No. 6.

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5. Reflective, Directional Polish: ASTM A480/A480M, No. 7.
6. Mirrorlike Reflective, Nondirectional Polish: ASTM A480/A480M, No. 8.

D. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M, No. 2B.

PART 3 - EXECUTION

3.1 REMOVAL, REPAIR, AND REINSTALLATION

A. General: Perform removal work as required in Section 024119 "Selective Demolition" for specific requirements relating to selectively demolishing construction, including decorative metal removal for repair or reinstallation elsewhere.

B. Defects in Painted Metal Surfaces: Repair nonload-bearing defects in existing metal surfaces, including dents and gouges more than [1/16 inch][1/8 inch]<**Insert dimension**> deep or [1/2 inch][1 inch]<**Insert dimension**> across, and all holes and cracks by filling with metal-patching compound and sanding smooth. Remove burrs and protruding fasteners. Prime iron and steel surfaces immediately after repair to prevent flash rusting.

C. Reinstalling [**Railing**][**and**][**Fence**] Posts: After posts have been inserted into sleeves, fill annular space between post and sleeve with [**nonshrink, nonmetallic grout**][**or**][**anchoring cement**], mixed and placed to comply with anchoring material manufacturer's written instructions. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch buildup sloped away from post.

D. Anchoring Wood Rails: Secure wood rails to metal subrail or brackets from bottom of wood rail as indicated on Drawings. Make fastener heads flush to metal surface.

E. Installing Sealant:

1. After metal reinstallation, keep joints to receive sealant dry and free of debris.
2. Clean and prepare joint surfaces according to Section 079200 "Joint Sealants."[**Prime joint surfaces unless sealant manufacturer recommends against priming.**] Do not allow primer to spill or migrate onto adjoining surfaces.
3. Fill sealant joints with specified joint sealant as recommended in writing by sealant manufacturer and according to Section 079200 "Joint Sealants" and the following:

    a. Install sealant using only proved installation methods that ensure sealant is deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding metal.
    b. Do not allow sealant to overflow or spill onto adjoining surfaces or to migrate into the voids of adjoining surfaces, particularly rough or sculptural textures. Promptly remove excess and spillage of sealant as the work progresses. Clean adjoining surfaces by means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.

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4. Cure sealant according to Section 079200 "Joint Sealants."

3.2 DECORATIVE METAL REPAIR SCHEDULE

A. Treatment for Decorative Railing [**DMR-1**]<**Insert drawing designation**>: Wrought-iron railing and gate.

1. General: Perform work [**in the shop**][**or**][**in the field**].
2. Paint Removal: As specified in Section 050170.51 "Decorative Metal Cleaning."
3. Repairs: Repair railing and replace missing components with hand-worked [**steel bars**][**wrought iron**].

    a. Apply repair primer immediately after repair.

4. Painted Finish: As specified in [**Section 090190.52 "Maintenance Repainting."**]<**Insert Section number and title.**>
5. Baked-Enamel or Powder-Coat Finish: [**Color as indicated by manufacturer's designations**][**Color matching design reference sample**][**Color matching Architect's sample**][**Color as selected by Architect from manufacturer's full range**]<**Insert color and gloss**>.

B. Treatment of Decorative Railing [**DMR-2**]<**Insert drawing designation**>: Cast-iron balustrade.

1. General: Perform work [**in the shop**][**or**][**in the field**].
2. Paint Removal: As specified in Section 050170.51 "Decorative Metal Cleaning."
3. Rust Removal: [**Chemical**][**Mechanical**]<**Insert method**>.
4. Repair: [**Patch with new material by filling, welding, brazing, or applying new metal material with fasteners**]<**Insert description**>.

    a. Apply repair primer immediately after repair.

5. Painted Finish: As specified in [**Section 090190.52 "Maintenance Repainting."**]<**Insert Section number and title.**>

C. Treatment of Decorative Railing [**DMR-3**]<**Insert drawing designation**>: Bronze railing with bronze handrail.

1. General: Perform work [**in the shop**][**or**][**in the field**].
2. Cleaning: As specified in Section 050170.51 "Decorative Metal Cleaning."
3. Repair: [**Splice new material into deteriorated section**]<**Insert description**>.
4. Bronze Finish: [**Satin finish with statuary conversion coating on railing; satin hand-rubbed finish, lacquered, on handrail**]<**Insert requirement**>.

D. Treatment of Decorative Railing and Handrail [**DMRH-1**]<**Insert drawing designation**>: Deteriorated bronze handrail on cast-iron railing.

1. Repair: Replace broken cast-iron railing components and repaint railing. Replace entire, deteriorated bronze handrail with shop-fabricated aluminum handrail.
2. Paint Removal: As specified in Section 050170.51 "Decorative Metal Cleaning."

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3. Railing Finish: Paint as specified in [**Section 090190.52 "Maintenance Repainting."**]<**Insert Section number and title.**>

    a. Color: [**As indicated by manufacturer's designations**][**Matching design reference sample**][**Matching Architect's sample**][**As selected by Architect from manufacturer's full range**]<**Insert color and gloss**>.

4. Handrail Finish:

    a. Aluminum Finish: [**Light bronze anodized**][**Medium bronze anodized**][**Dark bronze anodized**][**Anodized color matching design reference sample**][**Anodized color matching Architect's sample**][**Anodized color as selected by Architect from full range of industry colors and color densities**]<**Insert color**>.
    b. Baked-Enamel or Powder-Coat Finish: [**Color as indicated by manufacturer's designations**][**Color matching design reference sample**][**Color matching Architect's sample**][**Color as selected by Architect from manufacturer's full range**]<**Insert color and gloss**>.

5. Finish Treatment:

    a. Protective Coating: As specified in Section 050170.63 "Decorative Metal Refinishing."
    b. Painted Finish: As specified in [**Section 090190.52 "Maintenance Repainting."**]<**Insert Section number and title.**>

END OF SECTION 050170.61

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SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-formed steel framing.
2. Vertical deflection clips, interior.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, within height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittal: For cold-formed steel framing, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

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D. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.
2. Environmental Product Declaration (EPD): For each product.
3. Third-Party Certifications: For each product.
4. Third-Party-Certified Life-Cycle Assessment: For each product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and track.

D. Product Test Reports: For each listed product, for tests performed by [**manufacturer and witnessed by a qualified testing agency**][**a qualified testing agency**].

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Research Reports:

1. For nonstandard cold-formed steel framing [**post-installed anchors**][**and**][**power-actuated fasteners**], from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

F. Delegated Design Engineer Qualifications: For cold-formed steel framing.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by International Accreditation Service (IAS) to IAS AC98 criteria for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency[**, or in-house testing with calibrated test equipment,**] indicating steel sheet complies with requirements, including base-steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Track: Provide documentation that framing members are certified in accordance with the product-certification program of [**the Steel Framing Industry Association**][**the Steel Stud Manufacturers Association**][**or**][**the Supreme Steel Framing System Association**].

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D. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

E. Comply with AISI S230 for one- and two-family dwellings.

F. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [**state**]<**Insert jurisdiction**> where Project is located and who is experienced in providing engineering services of the type indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: [**As indicated on Drawings**]<**Insert design loads**>.
2. Deflection Limits: Design framing systems to withstand[**design loads**] without deflections greater than the following:

   a. Exterior Load-Bearing Wall Framing: Horizontal deflection of [**1/240**][**1/360**][**1/600**][**1/720**] of the wall height.
   b. Interior Load-Bearing Wall Framing: Horizontal deflection of [**1/240**][**1/360**] of the wall height under a horizontal load of **5 lbf/sq. ft.**.
   c. Exterior Non-Load-Bearing Framing: Horizontal deflection of [**1/240**][**1/360**][**1/600**][**1/720**]<**Insert ratio**> of the wall height.
   d. Interior Non-Load-Bearing Framing: Horizontal deflection of [**1/240**][**1/360**] of the wall height under a horizontal load of **5 lbf/sq. ft.**.
   e. Floor Joist Framing: Vertical deflection of [**1/360**][**1/480**] for live loads and l/240 for total loads of the span.
   f. Roof Rafter Framing: Vertical deflection of [**1/120**][**1/240**][**1/360**] of the horizontally projected span for live loads.
   g. Ceiling Joist Framing: Vertical deflection of [**1/120**][**1/240**][**1/360**] of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of **120 deg F**.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

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a. Upward and downward movement of [1/2 inch][3/4 inch][1 inch][1-1/2 inches].

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and [**ASTM C955**][**AISI S200 and ASTM C955, Section 8**][**AISI S240**].

D. Seismic Performance: Cold-formed steel framing to withstand the effects of earthquake motions determined in accordance with [**ASCE/SEI 7 and AISI S400**]<**Insert requirement**>.

E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Product iQ" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

F. Sound-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 COLD-FORMED STEEL FRAMING

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. [**AllSteel & Gypsum Products, Inc.**]
2. [**CEMCO; California Expanded Metal Products Co.**]
3. [**ClarkDietrich**]
4. [**Consolidated Fabricators Corp.; Building Products Division**]
5. [**CRACO Mfg., Inc.**]
6. [**Design Shapes in Steel**]
7. [**Formetal Co. Inc. (The)**]
8. [**Jaimes Industries, Inc.**]
9. [**Marino\WARE**]
10. [**MBA Metal Framing**]
11. [**Mill Steel Framing; Mill Steel Company**]
12. [**MRI Steel Framing, LLC**]
13. [**Olmar Supply, Inc**]
14. [**Quail Run Building Materials, Inc.**]
15. [**SCAFCO Steel Stud Company; Stone Group of Companies**]
16. [**State Building Products, Inc**]
17. [**Steel Construction Systems; Stone Group of Companies**]
18. [**Steel Network, Inc. (The)**]
19. [**Steeler, Inc**]

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20. [Super Stud Building Products Inc.]
21. [TELLING Industries]
22. [The Mill Steel Co]
23. [US Frame Factory]
24. <Insert manufacturer's name>

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Framing Members, General: Comply with [ASTM C955][AISI S200 and ASTM C955, Section 8][AISI S240] for conditions indicated.

D. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: [ST33H][ST50H][As required by structural performance]<Insert grade>.
2. Coating: [G60, A60, AZ50, or GF30][G90 or equivalent]<Insert coating designation>.

E. Steel Sheet for Vertical Deflection Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: [33][50, Class 1][As required by structural performance]<Insert grade>.
2. Coating: G90 <Insert coating designation>.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic-coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.4 Framing Accessories

A. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert

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manufacturer's name; product name or designation> or comparable product by one of the following:

1. <**Insert manufacturer's name**>

2.5 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, in accordance with AISI S240 and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install in accordance with Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, in accordance with Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 ft. and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative errors are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION OF COLD-FORMED STEEL FRAMING

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing in accordance with ASTM C1007, AISI S202, and

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manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install in accordance with Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.2 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom track sized to match studs. Align track accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: [**As shown on Shop Drawings**]<**Insert dimension**>.

B. Squarely seat studs against top and bottom track, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track.

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1. Fasten both flanges of studs to top and bottom track.
2. Space studs as follows:

    a. Stud Spacing: [12 inches][16 inches][19.2 inches][24 inches][**As indicated on Shop Drawings**]<**Insert dimension**>.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs in accordance with AISI S240, Section C3.5.2. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install track and jack studs above and below wall openings. Anchor track to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically [48 inches][**as indicated on Drawings**][**as indicated on Shop Drawings**]<**Insert dimension**>. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed in accordance with manufacturer's written instructions.

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J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom track. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.3 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated[**on Shop Drawings**].

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing as indicated on Shop Drawings.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: [12 inches][16 inches][19.2 inches][24 inches][**As indicated on Drawings**]<**Insert dimension**>.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated[**on Shop Drawings**]. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure

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pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.4 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 ft. and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 054000

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Shelf angles.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Prefabricated building columns.
6. Slotted channel framing.
7. Manufactured metal ladders.
8. Alternating tread devices.
9. Metal ships' ladders and pipe crossovers.
10. Metal bollards.
11. Vehicular barrier cable systems.
12. Pipe and downspout guards.
13. Abrasive metal nosings, treads, and thresholds.
14. Cast-iron wheel guards.
15. Metal downspout boots.

B. Shop Drawings: Show fabrication and installation details.[**Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.**] Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Elevator machine beams, hoist beams, and divider beams.
3. Steel shapes for supporting elevator door sills.
4. Steel girders for supporting wood frame construction.
5. Steel pipe columns for supporting wood frame construction.
6. Prefabricated building columns.

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7. Shelf angles.
8. Metal ladders.
9. Alternating tread devices.
10. Metal ships' ladders and pipe crossovers.
11. Metal floor plate and supports.
12. Elevator pit sump covers.
13. Structural-steel door frames.
14. Miscellaneous steel trim including [**steel angle corner guards**][**steel edgings**][**and**][**loading-dock edge angles**].
15. Metal bollards.
16. Loose steel lintels.
17. Vehicular barrier cable systems.

C. Samples for Verification: For each type and finish of extruded [**nosing**][**and**][**tread**].

D. Delegated Design Submittals: For [**ladders**][**alternating tread devices**][**and**][**vehicular barrier cable systems**], including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Sustainable Design Submittals:

1. Environmental product declaration.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Environmental Product Declaration: For each product.
4. Third-Party Certifications: For each product.
5. Third-Party Certified Life Cycle Assessment: For each product.

1.3 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research Reports: For post-installed anchors.

E. Delegated design engineer qualifications.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

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1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design [**ladders**][**alternating tread devices**][**and**][**vehicular barrier cable systems**].

B. Structural Performance of Aluminum Ladders: Ladders[**, including landings,**] are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

C. Structural Performance of Alternating Tread Devices: Alternating tread devices are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Comply with applicable railing loadings in Section 055213 "Pipe and Tube Railings."

D. Vehicular Barrier Cable Systems: Design vehicular barrier cable systems to resist a single [6000-lbf]<**Insert value**> service load and [10,000-lbf]<**Insert load**> ultimate load applied horizontally in any direction to the cable system, with anchorages or attachments capable of transferring this load to the structure. Limit deflection to 18 inches. Design is to assume loads are applied at a height of [18 inches]<**Insert height**> above the floor or ramp surface on an area not to exceed 1 sq. ft..

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: [120 deg F**, ambient;** 180 deg F**, material surfaces**]<**Insert temperature change**>.

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2.2 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with [**Section 099113 "Exterior Painting."**][**Section 099123 "Interior Painting."**][**Section 099600 "High-Performance Coatings."**][**Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."**]

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.3 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

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D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing[**and contour of welded surface matches that of adjacent surface**].

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches**, with a minimum **6-inch** embedment and **2-inch** hook, not less than **8 inches** from ends and corners of units and **24 inches** o.c., unless otherwise indicated.

2.4 VEHICULAR BARRIER CABLE SYSTEMS

A. Vehicular Barrier Cable Systems: Of diameter required by performance requirements, but not less than **1/2-inch-** diameter, [**zinc-coated steel wire rope**][**stainless steel wire rope**][**zinc-coated steel prestressing strand**] with turnbuckles, toggles, machine swage terminals, and other fittings and accessories for securing to structural columns and walls and for tightening barrier cable.

2.5 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

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2.6 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items[**not indicated to be galvanized**] unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with [**universal shop primer**][**primers specified in Section 099113 "Exterior Painting"**][**primers specified in Section 099123 "Interior Painting"**] unless [**zinc-rich primer is**][**primers specified in Section 099600 "High-Performance Coatings" are**] indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with [**SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."**][**SSPC-SP 3, "Power Tool Cleaning."**][**requirements indicated below:**]

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.7 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

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PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for [**ceiling-hung toilet partitions**][**operable partitions**][**overhead doors**][**and**][**overhead grilles**] securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction with [**expansion anchors**][**anchor bolts**][**through bolts**].

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D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

E. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF METAL SHIPS' LADDERS AND PIPE CROSSOVERS

A. Secure top and bottom of ships' ladders to construction to comply with manufacturer's written instructions.

B. Secure pipe crossovers to construction to comply with manufacturer's written instructions.

3.5 INSTALLATION OF METAL FLOOR PLATE

A. Install metal floor plates flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.6 INSTALLATION OF ELEVATOR PIT SUMP COVERS

A. Install tops of elevator sump pit cover plates and frames flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.7 INSTALLATION OF STRUCTURAL-STEEL DOOR FRAMES

A. Fasten structural steel door frames to the floor slab by means of angle clips and expansion bolts. Anchor door jambs to adjacent construction in accordance with shop drawing details.

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3.8 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.9 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

1. Do not fill removable bollards with concrete.

B. Anchor bollards to existing construction with [**expansion anchors**][**anchor bolts**][**through bolts**]. Provide four **3/4-inch** bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least **4 inches** in concrete.

C. Anchor bollards in concrete [**with pipe sleeves preset and anchored into concrete**][**in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard**]. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately **1/8 inch** toward bollard.

D. Anchor bollards in place with concrete footings. Center and align bollards in holes **3 inches** above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

E. Anchor internal sleeves for removable bollards in [**concrete by inserting in pipe sleeves preset into concrete**][**formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of sleeve**]. Fill annular space around internal sleeves solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately **1/8 inch** toward internal sleeve.

F. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes **3 inches** above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

G. Place removable bollards over internal sleeves and secure with **3/4-inch** machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.

H. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.10 INSTALLATION OF VEHICULAR BARRIER CABLE SYSTEMS

A. Install vehicular barrier cable systems at locations indicated, mounted at heights indicated on Drawings above the parking surface. Anchor [**wire ropes**][**steel**

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prestressing strand] to structural columns and walls and tension to withstand vehicle loading as specified in "Performance Requirements" Article with no cable tensioned less than 3000 lbf. Do not displace supporting components.

3.11 INSTALLATION OF PIPE AND DOWNSPOUT GUARDS

A. Provide pipe guards at exposed vertical pipes in [**parking garage**][**at locations indicated on Drawings**] where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.12 INSTALLATION OF CAST-IRON WHEEL GUARDS

A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.

3.13 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

END OF SECTION 055000

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SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Dimension lumber framing.
5. Miscellaneous lumber.
6. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
2. Section 064013 "Exterior Architectural Woodwork" for exterior wood stairs and railings.
3. Section 064023 "Interior Architectural Woodwork" for interior wood stairs and railings.
4. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

B. Sustainable Design Submittals:

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

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1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. [**MiTek Industries, Inc.**]
2. [**Simpson Strong-Tie Co., Inc.**]
3. [**Tamlyn**]
4. <**Insert manufacturer's name**>

B. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch- minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.

C. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: [3/4 inch][1-1/4 inches].
2. Thickness: [0.050 inch][0.062 inch].
3. Length: [16 inches][24 inches][**As indicated**].

D. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick.[**Tie fastens to side of rafter or truss, face of top plates, and side of stud below.**]

E. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

F. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.

G. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.

1. Bolt Diameter: [5/8 inch][3/4 inch].
2. Width: [2-1/2 inches][3-3/16 inches].
3. Body Thickness: [0.108 inch][0.138 inch].
4. Base Reinforcement Thickness: [0.108 inch][0.239 inch].

H. Wall Bracing:

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1. T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
2. Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

I. Materials: Unless otherwise indicated, fabricate from the following materials:

1. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

   a. Use for interior locations unless otherwise indicated.

2. Heavy-Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

   a. Use for wood-preservative-treated lumber and where indicated.

3. Stainless steel bars and shapes complying with ASTM A276/A276M, [**Type 304**][**Type 316**].

   a. Use for exterior locations and where indicated.

2.2 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets:

1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
2. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
3. Self-adhering sheet consisting of 64 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side[**; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction**].

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, [**butyl rubber**][**or**][**rubberized-asphalt**] compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of [**70**]<**Insert value**> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation

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of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate [**furring,**]nailers, blocking, [**grounds,**]and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.[**Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.**]

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

F. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

G. Do not splice structural members between supports unless otherwise indicated.

H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

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2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

J. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

K. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

L. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

N. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for[**screeding or**] attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

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B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring [**horizontally**][**and**][**vertically**] at [24 inches][**600 mm**] o.c.

C. Furring to Receive Gypsum Board or Plaster Lath: Install 1-by-2-inch nominal- size furring vertically at [16 inches][**400 mm**] o.c.

3.4 INSTALLATION OF WALL AND PARTITION FRAMING

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions[**and for load-bearing partitions where framing members bearing on partition are located directly over studs**]. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide [2-by-6-inch nominal-][2-by-4-inch nominal-] size wood studs spaced [24 inches][16 inches][**600 mm**][**400 mm**] o.c. unless otherwise indicated.
2. For interior partitions and walls, provide [2-by-6-inch nominal-][2-by-4-inch nominal-][2-by-3-inch nominal-] size wood studs spaced [24 inches][16 inches][**600 mm**][**400 mm**] o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs[**, except that two studs may be used for interior non-load-bearing partitions**].

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch

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nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated[**or, if not indicated, according to Table R602.7(1) or Table R602.7(2), as applicable, in ICC's International Residential Code for One- and Two-Family Dwellings**].

D. Provide diagonal bracing in [**exterior walls, at both walls of each external corner**][**walls, at locations indicated**], at 45-degree angle, full-story height unless otherwise indicated. Use [1-by-4-inch nominal- **size boards, let-in flush with faces of studs**][**metal wall bracing, let into studs in saw kerf**].

3.5 INSTALLATION OF FLOOR JOIST FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:

1. Where supported on wood members, by[**toe nailing or by**] using metal framing anchors.
2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.

C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.

E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.

H. Provide solid blocking between joists under jamb studs for openings.

I. Under non-load-bearing partitions, provide double joists separated by solid blocking

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equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

J. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.

1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- size lumber, double-crossed and nailed at both ends to joists.
2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and[toe nail or] use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

END OF SECTION 061000

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SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Shelving and clothes rods.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view[**and for framing exposed to view**].
2. Section 064023 "Interior Architectural Woodwork" for shop-fabricated carpentry.
3. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Interior trim.
2. Paneling.
3. Shelving and clothes rods.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

C. Sustainable Design Submittals:

1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
2. Environmental Product Declaration: For each product.
3. Third-Party Certifications: For each product.

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4. Third-Party Certified Life Cycle Assessment: For each product.
5. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
6. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
7. Product Data: For installation adhesives, indicating VOC content.
8. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

D. Samples: For each exposed product and for each color and texture specified.

E. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

F. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For foam-plastic moldings, with half of exposed surface finished; 50 sq. in..
3. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.3 QUALITY ASSURANCE

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Indigenous Materials: The following wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

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1. Interior trim.
2. Fire-rated interior door[**and sidelight**] frames.
3. Interior [**plywood**][**hardboard**][**board**] paneling.
4. Shelving[**and clothes rods**].
5. Interior [**stairs**][**and**][**railings**].

B. Certified Wood: The following wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.

1. Interior trim.
2. Fire-rated interior door[**and sidelight**] frames.
3. Interior [**plywood**][**hardboard**][**board**] paneling.
4. Shelving[**and clothes rods**].
5. Interior [**stairs**][**and**][**railings**].

C. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D6007 or ASTM E1333:

1. Hardwood Plywood: 0.05 ppm.
2. Particleboard: 0.09 ppm.
3. MDF More Than **5/16 Inch** Thick: 0.11 ppm.
4. MDF **5/16 Inch** or Less in Thickness: 0.13 ppm.

D. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber, mark grade stamp on end or back of each piece[**, or omit grade stamp and provide certificates of grade compliance issued by grading agency**].

E. Softwood Plywood: DOC PS 1.

F. Hardboard: ANSI A135.4.

G. MDF: ANSI A208.2, [**Grade 130**]<**Insert grade**>.

H. Particleboard: ANSI A208.1, [**Grade M-2**][**Grade M-2-Exterior Glue**].

I. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with ISO 4586-3, Grade VGS.

1. Color: [**White**][**Black**][**Gray**][**As indicated by manufacturer's designations**][**Match Architect's samples**][**As selected by Architect from manufacturer's full range**]<**Insert color**>.

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2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category [**UC1**][**UC2**].

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction[**and containing no arsenic or chromium**].
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.

    a. For exposed lumber indicated to receive a stained or natural finish, [**mark end or back of each piece**][**or**][**omit marking and provide certificates of treatment compliance issued by inspection agency**].

6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

    a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

7. Application: [**Where indicated on Drawings**][**All interior lumber and plywood**]<**Insert application**>.

2.3 SHELVING AND CLOTHES RODS

A. Shelving: [**Exposed**][**Closet**][**Utility**] shelving, made from [**the following material**][**one of the following materials**], 3/4 inch thick:

1. Particleboard with [**radiused and filled**][**or**][**solid-wood**] front edge.
2. MDF with [**radiused**][**or**][**solid-wood**] front edge.
3. MDO softwood plywood with solid-wood edge.
4. Melamine-faced particleboard with [**radiused and filled**][**applied-PVC**] front edge.
5. Wood boards as specified above for [**lumber trim for opaque**][**softwood lumber trim for transparent**][**hardwood lumber trim for transparent**] finish.
6. Softwood Boards:

    a. Kiln-dried eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NeLMA, NLGA, or WWPA [**C Select (Choice)**][**D Select (Quality)**][**Finish or 1 Common (Colonial)**][**Premium or 2 Common (Sterling)**].
    b. Kiln-dried Douglas fir-larch, Douglas fir south, or hem-fir; SPIB [**Superior or C & Btr**][**Prime or D**] finish; NLGA, WCLIB, or WWPA; or southern pine; [**B & B**][**C**] finish.

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B. Shelf Cleats: [3/4-by-3-1/2-inch boards][3/4-by-5-1/2-inch boards][3/4-by-5-1/2-inch boards with hole and notch to receive clothes rods], as specified above for [shelving][lumber trim for opaque finish][softwood lumber trim for transparent finish][hardwood lumber trim for transparent finish].

C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [A&M Hardware, Inc.]
b. [EPCO, Engineered Products Co.]
c. [Knape & Vogt Manufacturing Company]
d. <Insert manufacturer's name>

D. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; [powder-coat-finished][brass-finished][zinc-plated] steel.

E. Adjustable Shelf Brackets: BHMA A156.9, B04112; [powder-coat-finished steel][brass-finished steel][zinc-plated steel][bronze-anodized aluminum][black-anodized aluminum][natural aluminum].

F. Standards for Adjustable Shelf Supports: BHMA A156.9, B04071; [powder-coat-finished][brass-finished][zinc-plated] steel.

G. Adjustable Shelf Supports: BHMA A156.9, B04081 or B04091; [powder-coat-finished][brass-finished][zinc-plated] steel.

H. Wood Clothes Rods: 1-1/2-inch- diameter, clear, kiln-dried [hardwood][Douglas fir or southern pine].

I. Metal Clothes Rods: 1-5/16-inch- diameter, [aluminum tubes][chrome-plated-steel tubes][color-coated-steel tubes][stainless steel tubes][chrome-plated-steel telescoping tubes with end brackets for mounting on shelf cleats].

J. Wood Rod Flanges: Clear, kiln-dried, [Douglas fir or southern pine][eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine][red oak][white maple][aspen, basswood, cottonwood, sap gum, white maple, or yellow poplar]<Insert species> turnings[with clear finish].

K. Metal Rod Flanges: [Aluminum][Chrome-plated steel][Stainless steel].

2.4 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

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B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
2. Adhesives shall have a VOC content of [30]<**Insert value**> g/L or less.

C. Installation Adhesive for Foam-Plastic Moldings: Product recommended for indicated use by foam-plastic molding manufacturer.

1. Adhesives shall have a VOC content of [50]<**Insert value**> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

D. Paneling Adhesive: Comply with paneling manufacturer's written instructions for adhesives.

1. Adhesives shall have a VOC content of [50]<**Insert value**> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

E. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

1. Adhesives shall have a VOC content of [70]<**Insert value**> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.5 FABRICATION

A. Back out or kerf backs of the following members, except those with ends exposed in finished work:

1. Interior standing and running trim, except shoe and crown molds.
2. Wood-board paneling.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

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PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.2 INSTALLATION OF SHELVING AND CLOTHES RODS

A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.

1. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled.
2. Space fasteners not more than 16 inches o.c.[**Use two fasteners at each framing member or fastener location for cleats 4 inches nominal in width and wider.**]
3. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing.
4. Remove adhesive that is squeezed out after fastening shelf cleats in place.

B. Install shelf brackets according to manufacturer's written instructions, spaced not more than [32 inches][36 inches] o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

C. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

D. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed

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and reinstalled.

1. Install shelves, fully seated on cleats, brackets, and supports.
2. Fasten shelves to cleats with finish nails or trim screws, set flush.
3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

F. Install rod flanges for rods as indicated.

1. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
2. Install rods in rod flanges.

END OF SECTION 062023

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SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim for transparent finish.
2. Interior standing and running trim for opaque finish.
3. Closet and utility shelving.
4. Interior frames and jambs for opaque finish.
5. Interior wood railings.
6. Preservative-treated wood material.
7. Miscellaneous materials.
8. Shop priming.
9. Field finishing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
2. Section 062023 "Interior Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Sustainable Design Submittals:

1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
2. Environmental Product Declaration: For each product.

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3. Third-Party Certifications: For each product.
4. Third-Party Certified Life Cycle Assessment: For each product.
5. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
6. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
7. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.

C. Shop Drawings:

1. Include the following:

   a. Dimensioned plans, elevations, and sections.
   b. Attachment details.

2. Show [**large-scale**][**full-size**] details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
4. Apply [**AWI Quality Certification**][**WI Certified Compliance**] Program label to Shop Drawings.

D. Samples: For each exposed product and for each shop-applied color and finish specified.

1. Size:

   a. Panel Products: 12 inches by 12 inches.
   b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

E. Samples for Initial Selection: For each type of shop-applied exposed finish.

1. Size:

   a. Panel Products: 12 inches by 12 inches.
   b. Lumber Products: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

F. Samples for Verification: For the following:

1. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished interior architectural woodwork.
2. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and [8 by 10 inches][12 by 12 inches] for panels, for each finish system and color.

   a. Finish [**entire**][**one-half of**] exposed surface.

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1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and Installer.

B. Product Certificates: For the following:

1. Composite wood products.
2. Adhesives.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: [**AWI Quality Certification Program**][**WI Certified Compliance Program**] certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in [**AWI's Quality Certification Program**][**WI's Certified Compliance Program**].
2. Installer Qualifications: [**Manufacturer of products**][**and**][**Licensed participant in AWI's Quality Certification Program**][**Licensed participant in WI's Certified Compliance Program**].

1.7 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between [**25 and 55**][**43 and 70**][**20 and 50**]<**Insert number**> percent during the remainder of the construction period.

C. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

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D. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Frames: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

2.2 WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide [**labels**][**and**][**certificates**] from [**AWI**][**WI**] certification program indicating that woodwork[**and installation**] complies with requirements of grades specified.

a. This project has been registered with AWI as AWI Quality Certification Program Number <**Insert number**>.

2. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.

B. Indigenous Materials: Wood products shall be manufactured within **500 miles** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

C. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme

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for Endorsement of Forest Certification.

2.3 INTERIOR WOOD STAIRS AND RAILINGS

A. Architectural Woodwork Standards Grade: [**Premium**][**Custom**][**Economy**].

B. Wood for Transparent Finish:

1. Species and Cut:

a. Stringers: [**Red oak, plain sawn**][**Red oak, quarter sawn**][**Hard maple, plain sawn**]<**Insert species and cut**>.
b. Risers: [**Red oak, plain sawn**][**Red oak, quarter sawn**][**Hard maple, plain sawn**]<**Insert species and cut**>.
c. Treads: [**Red oak, plain sawn**][**Red oak, quarter sawn**][**Hard maple, plain sawn**]<**Insert species and cut**>.
d. Railings: [**Red oak, plain sawn**][**Red oak, quarter sawn**][**Hard maple, plain sawn**]<**Insert species and cut**>.
e. Balusters: [**Red oak, plain sawn**][**Red oak, quarter sawn**][**Hard maple, plain sawn**]<**Insert species and cut**>.
f. Newels: [**Red oak, plain sawn**][**Red oak, quarter sawn**][**Hard maple, plain sawn**]<**Insert species and cut**>.
g. Moldings: [**Red oak, plain sawn**][**Red oak, quarter sawn**][**Hard maple, plain sawn**]<**Insert species and cut**>.

2. Wood Moisture Content: [**5 to 10**][**8 to 13**][**4 to 9**] percent.

C. Wood for Opaque Finish:

1. Species: [**Any closed-grain hardwood**][**Eastern white pine, sugar pine, or western white pine**][**Any closed-grain hardwood, except that eastern white pine, sugar pine, or western white pine may be used for risers, stringers, and moldings**]<**Insert species**>.
2. Wood Moisture Content: [**5 to 10**][**8 to 13**][**4 to 9**] percent.

D. Rough Carriage Stairs:

1. Laminated veneer lumber, made with an exterior-type adhesive complying with ASTM D2559, and with the following allowable design values as determined in accordance with ASTM D5456:

a. Extreme Fiber Stress in Bending, Edgewise: [3100 psi][2900 psi][2600 psi][2250 psi]<**Insert value**> for 12-inch nominal- depth members.
b. Modulus of Elasticity, Edgewise: [2,000,000 psi][1,800,000 psi][1,500,000 psi]<**Insert value**>.

2. Wood Grade: [**Select Structural**][**No. 1**][**No. 2**], kiln-dried to 15 percent maximum moisture content.

a. Acceptable Species:

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1) Hem-fir (north).
2) Southern pine.
3) Douglas fir-larch.
4) Douglas fir-larch (north).
5) Spruce-pine-fir.
6) Hem-fir.
7) Douglas fir-south.
8) Spruce-pine-fir (south).

E. Finishes for Stair Parts:

1. Treads: [**Transparent**][**Opaque**].
2. Risers: [**Transparent**][**Opaque**].
3. Stringers: [**Transparent**][**Opaque**].
4. Balusters: [**Transparent**][**Opaque**].
5. Handrails: [**Transparent**][**Opaque**].
6. Scotia, Cove, and Other Moldings: [**Transparent**][**Opaque**].

F. Handrail Brackets: [**Cast nickel-silver**][**Cast aluminum**][**Cast bronze**][**Cast stainless steel**] with wall flange drilled [**for exposed anchor**][**and tapped for concealed hanger bolt**] and with support arm for screwing to underside of rail. Size to provide **1-1/2-inch** clearance between handrail and face of wall.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Julius Blum & Co., Inc.**]
b. [**The Wagner Companies**]
c. <**Insert manufacturer's name**>

G. Handrail/Bumper Rail Brackets: Pairs of extruded-aluminum channels: one for fastening to back of rail and one for fastening to face of wall, assembled in overlapping fashion and fastened together at top and bottom with self-tapping screws. Size to provide **1-1/2-inch** clearance between handrail and wall.

2.4 HARDWOOD SHEET MATERIALS

A. Composite Wood Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert value**> percent.
2. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D6007 or ASTM E1333:

a. Hardwood Plywood: 0.05 ppm.

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b. Particleboard: 0.09 ppm.
c. MDF More Than 5/16 Inch Thick: 0.11 ppm.
d. MDF 5/16 Inch or Less in Thickness: 0.13 ppm.

3. Medium-Density Fiberboard (MDF): ANSI A208.2, [**Grade 130**]<**Insert grade**>.
4. Particleboard: ANSI A208.1, [**Grade M-2**][**Grade M-2-Exterior Glue**].
5. Softwood Plywood: DOC PS 1[**, medium-density overlay**].
6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: [**Softwood or hardwood lumber**][**Fire-retardant-treated softwood lumber**], kiln-dried to less than 15 percent moisture content.

1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.

a. Provide [**where indicated**][**where in contact with concrete or masonry**]<**Insert requirements**>.
b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
c. Preservative Chemicals: Acceptable to authorities having jurisdiction[**and containing no arsenic or chromium**].
d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

2. Fire-Retardant Treatment: Complying with requirements; provide [**where indicated**]<**Insert requirements**>.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

E. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

1. Adhesives shall have a VOC content of [**70**]<**Insert value**> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

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2.6 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:

a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.

a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

D. Stairs: Cut rough carriages to accurately fit treads and risers.

1. Glue treads to risers, and glue and nail treads and risers to carriages.
2. House [**wall**][**and**][**face**] stringers, and glue and wedge treads and risers.
3. Fabricate stairs with treads and risers no more than 1/8 inch from indicated position and no more than 1/16 inch out of relative position for adjacent treads and risers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

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C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes in accordance with AWPA M4.

F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails[**or finishing screws**] for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

H. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than [36 inches][60 inches][96 inches] long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with [**plastic wood filler; sand smooth; and finish same as wood base if finished**][**latex sealant, painted to match wall**].
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

I. Stairs: Securely anchor carriages to supporting substrates.

1. Install stairs with treads and risers no more than 1/8 inch from indicated position.
2. Secure with countersunk, concealed fasteners and blind nailing.
3. Use fine finishing nails[**or finishing screws**] for exposed fastening, countersunk and filled flush with wood surface.

J. Railings:

1. Install rails with no more than 1/8 inch in 96-inch variation from a straight line.
2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.

a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails[**or finishing screws**] for exposed fastening,

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countersunk and filled flush with wood surface.

3. Wall Rails: Support rails on wall brackets securely fastened to wall framing.

a. Space rail brackets not more than <**Insert dimension**> o.c.

3.2 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through [**AWI's Quality Certification Program**][**WI's Certified Compliance Program**] certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

END OF SECTION 064023

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SECTION 064100 - ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

1. Wood-veneer-faced casework for transparent finish.
2. Wood-veneer-faced casework for opaque finish.
3. Wood materials.
4. Casework hardware.
5. Shop finishing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud-framing required for anchoring cabinets.
3. [**Section 123616 "Metal Countertops."**][**Section 123619 "Wood Countertops."**][**Section 123623.13 "Plastic-Laminate-Clad Countertops."**][**Section 123640 "Stone Countertops."**][**Section 123661 "Simulated Stone Countertops."**]

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference [**at Project site**][**by web conference**]<**Insert location**>.

1. Review locations and method of attachment of backing required for casework installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include panel material description and finish.
2. Include glazing.
3. Include accessories.
4. Include hardware.
5. Include shop finishing.

B. Shop Drawings:

1. Plans, elevations, sections, and attachment details.

a. Show large-scale details.

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b. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
c. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.
d. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

2. Apply AWI's Quality Certification Program (hereafter AWI QCP) label to Shop Drawings.

C. Samples for Initial Selection: For each exposed product and for each color and finish specified, in manufacturer's standard size.

D. Samples for Verification: Provide a minimum of three samples showing the full range of color and/or grain to be expected in the finished work, for the following.

1. Lumber for Transparent Finish: Not less than 8 inches long by 3/4 inch thick, and as wide as practical, for each species and cut, finished on one side and one edge.
2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished cabinets. Samples to show the full range of color and grain to be expected.
3. Veneer Panel for Transparent Finish: 8 by 8 inches by 1/4 inch, representative of and selected from flitches to be used for transparent-finished casework.
4. Lumber and Panel Products with Shop-Applied Opaque Finish: Not less than 8 inches long by 3/4 inches thick, and as wide as practical, for each species and cut for lumber and 8 by 10 inches for panels, for each finish system and color.

    a. Finish [**entire**][**one-half of**] exposed surface.

5. Plastic Laminates: 8 by 8 inches, for each type, color, pattern, and surface finish required.

    a. Provide one Sample applied to core material with specified edge material applied to one edge.

6. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches, for each color, pattern, and surface finish.

    a. Provide edgebanding on one edge.

7. Corner Pieces:

    a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    b. Miter joints for standing trim.

8. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

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E. Sustainable Design Submittals:

1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
2. Product Data: Verify compliance with requirements for Forest Stewardship Council U.S. (FSC).
3. Laboratory Test Reports: For composite wood products, indicating compliance with the formaldehyde emissions evaluation.
4. Product Data: For installation adhesives, indicating VOC content.
5. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

A. Test Reports: Valid AWI "Performance Quality Test Report" indicating compliance with specified ANSI/AWI 0641 Structural Performance Duty Level.

B. Certification Reports:

1. Provide [**labels**][**and**][**certificates**] from AWI QCP indicating woodwork [**complies**][**and installation comply**] with requirements of aesthetic grade and duty level specified.

a. Project has been registered with AWI as AWI QCP Number <**Insert number**>.
b. Register the Work of this Section with AWI's Quality Certification Program.

C. Product Certificates: For[**each type of product.**][**the following:**]

1. Composite wood products.
2. Thermally fused laminate (TFL) panels.
3. Glass.
4. Adhesives.

D. Field quality control reports.

E. Qualification Statements: For [**manufacturer**][**and**][**Installer**].

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI QCP Certificate.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of

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successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: [**Manufacturer of products**][**Licensed participant in AWI QCP**].

1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of [**typical architectural cabinets as indicated on Drawings**]<**Insert description**>.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between [**25 and 45**][**30 and 55**][**43 and 65**]<**Insert numbers**> percent during the remainder of the construction period.

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated, comply with ANSI/AWI 0641 for duty level and grade of architectural cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide [**labels**][**and**][**certificates**] from AWI QCP indicating that woodwork [**complies**][**and installation comply**] with requirements of aesthetic grade and duty level specified.
2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of the Contract Documents in addition to those of the referenced quality standard.

2.2 Cabinet Hardware

A. Basis-of-Design Product: Subject to compliance with requirements, provide <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

1. [**Hardware Resources**]
2. <**Insert manufacturer's name**>

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content:

a. Non-Climate-Controlled Environments: [**7 to 12**][**9 to 15**][**10 to 15**] percent.
b. Climate-Controlled Environments: [**4 to 9**][**6 to 10**][**8 to 13**] percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert number**> percent.
2. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:

a. Hardwood Plywood: 0.05 ppm.
b. Particleboard: 0.09 ppm.

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c. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
d. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.

3. Medium-Density Fiberboard (MDF): ANSI A208.2, [**Grade 130**]<**Insert grade**>.
4. Particleboard (Medium Density): ANSI A208.1, [**Grade M-2**][**Grade M-2-Exterior Glue**].
5. Softwood Plywood: DOC PS 1[**, medium-density overlay**].
6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
7. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper[**and complying with requirements of AWI 300**].

2.4 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated. Ease sharp edges and corners.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

D. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in NGA's "GANA Glazing Manual."

1. For glass in wood frames, secure glass with removable stops.
2. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION OF CASEWORK

A. Install casework to comply with requirements of the structural and aesthetic performance specified.

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B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Maintain veneer sequence matching of cabinets with transparent finish.

D. Anchor cabinets in accordance with AWI requirements or tested method to anchors or blocking built in or directly attached to framing or substrates.

1. Install cabinets to comply with seismic requirements as indicated on Drawings.

E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching filler.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

a. Use filler matching finish of items being installed.

F. Field Finishing: See [**Section 099123 "Interior Painting"**][**and**][**Section 099300 "Staining and Transparent Finishing"**] for finishing of installed architectural cabinets.

3.2 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that casework, including installation, complies with requirements of ANSI/AWI 0620 for the specified grade.

1. AWI QCP Inspector to prepare and submit inspection report.

END OF SECTION 064100

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SECTION 081116.13 - INTERIOR ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior aluminum doors and frames.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, [**fire rating,**]and finishes.
b. <**Insert requirements**>.

B. Shop Drawings:

1. Elevations, sections, and installation details for each wall-opening condition.
2. Details of construction of each component, including dimensioned profiles and metal thicknesses.
3. Locations of reinforcements and preparations for hardware.
4. Details of anchorages, joints, splices, connections, and accessories.
5. Details of trim, removable stops, and glazing.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Samples for Verification: Actual sample of finished products for each type of the following products:

1. Framing Member and Finish: 12 inches long. Include trim.
2. Window Corner Fabrication and Finish: 12-by-12-inch- long, full-size corner, including full-size sections of extrusions with removable stops.
3. Door Finish: Manufacturer's standard-size unit, but not less than [3 inches square]<**Insert dimensions**>.

E. Product Schedule: Use same designations indicated on Drawings. Coordinate with

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door hardware schedule and glazing.

F. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.

1.4 INFORMATIONAL SUBMITTALS

A. Oversize Fire-Rated Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

B. Field Quality-Control Reports: For [**fire-rated**][**smoke- and draft-control**][**and**][**egress**] door assemblies.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For interior aluminum doors and frames.

1.6 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Documented as complying with requirements in NFPA 80 [**and having Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification**]<**Insert requirements**>.

B. Egress Door Inspector Qualifications: Documented as complying with requirements in NFPA 101 [**and having Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification**]<**Insert requirements**>.

1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup [**as indicated on Drawings**]<**Insert mockup requirements**>.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Complying with requirements in NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated [**on Drawings**][**in schedules**], based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control based on testing in accordance with UL 1784 by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 INTERIOR ALUMINUM DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. [**Alpha Aluminum Architectural Products**]
2. [**Avalon International Aluminum LLC**]
3. [**DIRTT Environmental Solutions**]
4. [**Frameworks**]
5. [**Modulex Products, Inc**]
6. [**RACO Interiors**]
7. [**Special-Lite**]
8. [**Speed View USA**]
9. [**Tubelite Inc.**]
10. [**Western Integrated Materials, Inc.**]
11. [**Wilson Partitions; a division of Arcadia Inc.**]
12. <**Insert manufacturer's name**>

B. Source Limitations: Obtain interior aluminum doors and frames from single source from single manufacturer.

C. Aluminum Framing: **ASTM B221**, with alloy and temper required to suit structural and finish requirements, and not less than **0.062 inch** thick.

D. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.

E. Glazing Frames: Extruded aluminum, for glass thickness [**indicated on Drawings**][**indicated in schedules**]<**Insert requirements**>.

F. Sliding-Door Head Tracks: Extruded aluminum where exposed; provide complete with door-hanging roller assemblies and floor guides.

G. Pocket-Door Frame Assemblies: Extruded aluminum where exposed, complete with sliding-door head tracks, wall-pocket frames, door-hanging roller assemblies, and floor

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guides.

H. Trim: Extruded aluminum, not less than 0.062 inch thick; removable, snap-in [**casing trim**][**glazing stops**][**and**][**door stops**], without exposed fasteners.

1. Trim Style: [**As indicated on Drawings**]<**Insert requirements**>.

I. Aluminum-Framed Glass Doors: Manufacturer's standard, factory-assembled, 1-3/4-inch- thick doors.

1. Stile Width: [**As indicated on Drawings**][**Narrow**][**Medium**][**Wide**][3-3/4 inches]<**Insert requirements**>.
2. Top-Rail Height: [**As indicated on Drawings**][3-3/4 inches][6 inches]<**Insert dimension**>.
3. Bottom-Rail Height: [**As indicated on Drawings**][6 inches][**Provides smooth surface within** 10 inches **of finished floor measured vertically**]<**Insert dimension**>.

2.3 ACCESSORIES

A. Fire-Rated Door Assemblies: Comply with requirements of tested assembly.

B. Smoke- and Draft-Control Door Assemblies: Comply with requirements of tested assembly.

C. Wood Doors: As specified in [**Section 081416 "Flush Wood Doors."**]<**Insert requirements.**>

D. Fasteners: Aluminum, nonmagnetic, stainless steel, zinc-plated steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

E. Corner Reinforcements and Alignment Clips: Manufacturer's standard concealed units to provide accurately fitted hairline joints at butted and mitered connections.

F. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals, [**in manufacturer's standard color**][**black**]<**Insert requirements**>.

G. Glazing Gaskets: Manufacturer's standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; [**in manufacturer's standard color**][**black**][**gray**]<**Insert color**>.

H. Glazing Stops: Removable to allow glazing replacement without framing disassembly.

I. Glass: As specified in [**Section 088000 "Glazing."**][**Section 088813 "Fire-Rated Glazing."**]<**Insert glazing requirements.**>

J. Door Hardware: [**As selected by Architect from manufacturer's full range.**][**As specified in Section 087100 "Door Hardware."**][**As specified in Section 087111 "Door Hardware (Descriptive Specification)."**]<**Insert requirements.**>

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2.4 FABRICATION

A. Hardware Preparation: Factory prepare components to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping.

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted hardware.
2. Locate hardware as indicated [**on Drawings**]<**Insert requirements**>.

B. Glazing Stops: Locate removable stops on inside of spaces accessed by locking doors.

C. Fabricate components to allow secure installation without exposed fasteners and to provide accurately fitted hairline joints at butted and mitered connections.

D. Fabricate frame components [96 inches][108 inches]<**Insert dimension**> long or shorter as one piece. Where splices are required, no individual piece may be less than [48 inches]<**Insert dimension**> long.

E. Fabricate door assemblies for sliding operation to conceal door-hanging roller assemblies from view.

2.5 ALUMINUM FINISHES

A. Comply with NAAMM/NOMMA AMP 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.

E. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A34, Class II, 0.010 mm**] or thicker.

1. Color: [**Light bronze**][**Medium bronze**][**Dark bronze**][**Black**][**Match Architect's sample**][**As selected by Architect from full range of industry colors and color densities**]<**Insert color**>.

F. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry-film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and curing finish.

1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<**Insert color and gloss**>.

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PART 3 - EXECUTION

3.1 INSTALLATION OF ALUMINUM DOORS AND FRAMES

A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place in accordance with manufacturer's written instructions.

1. Fire-Rated Door Assemblies: Install in accordance with NFPA 80.
2. Smoke- and Draft-Control Door Assemblies: Install in accordance with NFPA 105.
3. Fasten to suspended ceiling grid on maximum [48-inch]<**Insert dimension**> centers, using sheet metal screws or other fasteners approved by frame manufacturer.
4. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
5. Secure clips to extruded main-frame components and not to snap-in or trim members.
6. Do not leave screws or other fasteners exposed to view when installation is complete.

B. Glass: Install glass in accordance with [**Section 088000 "Glazing"**][**Section 088113 "Decorative Glass Glazing"**][**Section 088400 "Plastic Glazing"**][**Section 088813 "Fire-Rated Glazing"**] and aluminum-frame manufacturer's written instructions.

C. Doors: Install doors aligned with frames and fitted with required hardware.

1. Wood Doors: Install in accordance with [**Section 081416 "Wood Doors" and**] aluminum-frame manufacturer's written instructions.
2. Hardware: Install in accordance with [**Section 087100 "Door Hardware" and**][**Section 087111 "Door Hardware (Descriptive Specification)" and**] aluminum-frame manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner will engage**][**Engage**] a qualified testing agency to perform tests and inspections.

B. Fire-Rated Door Assembly Acceptance Testing: Test and inspect fire-rated door assemblies in accordance with NFPA 80.

C. Smoke- and Draft-Control Door Assembly Acceptance Testing: Test and inspect smoke- and draft-control door assemblies in accordance with NFPA 105.

D. Egress Door Assembly Acceptance Testing: Test and inspect egress doors in accordance with NFPA 101.

E. Repair or remove and replace installations where testing and inspections indicate that they do not comply with specified requirements.

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F. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

G. Prepare test and inspection reports.

END OF SECTION 081116.13

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors and transom panels with plastic-laminate-faces.
2. Hollow-core flush wood doors for opaque finish.
3. Hollow-core flush wood doors with plastic-laminate faces.

B. Related Requirements:

1. Section 064023 "Interior Architectural Woodwork" for wood door frames[**including 20-minute fire-rated wood door frames**].
2. Section 064216 "Flush Wood Paneling" for requirements for veneers from the same flitches for both flush wood doors and flush wood paneling.
3. Section 083473.16 "Wood Sound Control Door Assemblies" for acoustic flush wood doors.
4. Section 088000 "Glazing" for glass view panels in flush wood doors.
5. [**Section 099113 "Exterior Painting"**][**Section 099123 "Interior Painting"**][**and**][**Section 099300 "Staining and Transparent Finishing"**] for field finishing doors.
6. Section 134900 "Radiation Protection" for lead-lined flush wood doors.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.
2. Solid-core five-ply flush wood doors and transom panels for opaque finish.
3. Solid-core seven-ply flush wood veneer-faced doors and transom panels for transparent finish.
4. Solid-core seven-ply flush wood doors and transom panels for opaque finish.
5. Solid-core flush wood doors and transom panels with plastic-laminate-faces.
6. Hollow-core flush wood veneer-faced doors for transparent finish.
7. Hollow-core flush wood doors for opaque finish.
8. Hollow-core flush wood doors with plastic-laminate faces.
9. Fire-rated wood door frames.
10. Light frames and louvers.

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B. Product Data Submittals: For each product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory-[priming][finishing] specifications.

C. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.
2. Third-Party Certifications: For each product.
3. Third-Party Certified Life Cycle Assessment: For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
6. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
7. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.

D. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door[and frame] location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory [primed][finished] and application requirements.
10. Apply [AWI Quality Certification][WI Certified Compliance] Program label to Shop Drawings.

E. Samples for Initial Selection: For [plastic-laminate door faces][polymer edging][factory-finished doors][and][factory-finished door frames].

F. Samples for Verification:

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1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.[**For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.**]
2. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.
3. Polymer edging, in manufacturer's standard colors.
4. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
5. Louver blade and frame sections, 6 inches long, for each material and finish specified.
6. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Quality Standard Compliance Certificates: [**AWI Quality Certification**][**WI Certified Compliance**] Program certificates.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in [**AWI's Quality Certification Program**][**WI's Certified Compliance Program**].

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

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C. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.7 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.
2. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between [**25 and 55**][**43 and 70**][**17 and 50**]<**Insert numbers**> percent during remainder of construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors[**and frames**] that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors[**and frames**].
3. Warranty Period for Solid-Core Exterior Doors: [**Two**][**Five**]<**Insert number**> years from date of Substantial Completion.
4. Warranty Period for Solid-Core Interior Doors: Life of installation.
5. Warranty Period for Hollow-Core Interior Doors: [**One**][**Two**]<**Insert number**> year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings [**and temperature-rise limits**]indicated on Drawings, based on testing at positive pressure in accordance with [**UL 10C**][**or**][**NFPA**

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1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: [**Where indicated on Drawings**][**At vertical exit enclosures and exit passageways**], provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with [**AWI/AWMAC/WI's "Architectural Woodwork Standards."**][**ANSI/WDMA I.S. 1A.**]

1. Provide [**labels**][**and**][**certificates**] from [**AWI**][**WI**] certification program indicating that doors[**and frames**] comply with requirements of grades specified.

    a. This project has been registered with AWI as AWI Quality Certification Program Number <**Insert number**>.
    b. Contractor registers the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.

2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

B. Indigenous Materials: Wood doors shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

C. Certified Wood: Wood doors shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

E. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D6007 or ASTM E1333:

1. Hardwood Plywood: 0.05 ppm.
2. Particleboard: 0.09 ppm.

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3. MDF More Than 5/16 Inch Thick: 0.11 ppm.
4. MDF 5/16 Inch or Less in Thickness: 0.13 ppm.

2.3 HOLLOW-CORE FLUSH WOOD DOORS FOR OPAQUE FINISH

A. Interior Doors, Hollow Core for Opaque Finish:

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

    a. [**ABS- American Building Supply- Doormerica**]
    b. [**Chappell Door Co**]
    c. [**General Veneer Manufacturing Co**]
    d. [**Haley Brothers, Inc**]
    e. [**Lambton Doors**]
    f. [**Lynden Door, Inc.**]
    g. [**Oregon Door**]
    h. [**Vancouver Door Company**]
    i. <**Insert manufacturer's name**>

2. Performance Grade: WDMA ANSI/I.S. 1A Standard Duty.
3. ANSI/WDMA I.S. 1A Quality Grade: [**Premium**][**Custom**].
4. Architectural Woodwork Standards Quality Grade: [**Premium**][**Custom**].
5. Faces: [**Any closed-grain hardwood of mill option**][**Hardboard or MDF**].

    a. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).
    b. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.

6. Exposed Vertical and Top Edges: Any closed-grain hardwood.
7. Construction: [**Institutional**][**Standard**] hollow core.
8. Blocking: Provide wood blocking with minimum dimensions as follows:

    a. 5-by-18-inch lock blocks[**at both stiles**].
    b. 5-inch top-[**and bottom-**]rail blocking.
    c. 10-inch[**top- and**] bottom-rail blocking.
    d. 2-1/2-inch midrail blocking.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

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1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:

1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
3. Fabricate door and transom panels with full-width, solid-lumber[**, rabbeted,**] meeting rails.
4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory [**priming**][**finishing**].

1. Flash top of outswinging doors with manufacturer's standard metal flashing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see [**Section 087100 "Door Hardware."**][**Section 087111 "Door Hardware (Descriptive Specification)."**]

B. Install doors[**and frames**] to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

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a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails[**or finishing screws**] for exposed fastening, countersunk and filled flush with woodwork.

1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

A. Inspection Agency: [**Owner will engage**][**Engage**] a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Provide inspection of installed Work through [**AWI's Quality Certification Program**][**WI's Certified Compliance Program**], certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with

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NFPA 80, Section 5.2.

3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in [NFPA 80][and][NFPA 101].

END OF SECTION 081416

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SECTION 085313 - VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl windows.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate interrelationship of vinyl windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings:

1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish:

1. Exposed Finishes: [2 by 4 inches]<**Insert dimensions**>.

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2. Exposed Hardware: Full-size units.

E. Product Schedule: For vinyl windows. Use same designations indicated on Drawings.

F. Delegated Design Submittals: For reinforcing mullions, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Sustainable Design Submittals:

1. Product Data: For installation adhesives, indicating VOC content.
2. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For indicated products, indicating compliance with requirements for ENERGY STAR product labeling.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of vinyl window, for tests performed by [**a qualified testing agency**][**manufacturer and witnessed by a qualified testing agency**].

B. Field Quality-Control Reports: For vinyl windows.

C. Qualification Statements: For manufacturer and Installer.

D. Delegated Design Engineer Qualifications: For reinforcing mullions.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating vinyl windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: Authorized representative who is trained and approved by vinyl window manufacturer.

C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [**state**]<**Insert jurisdiction**> where Project is located and who is experienced in providing engineering services of the type indicated.

D. Testing Agency Qualifications: An FGIA-accredited testing agency for testing indicated.

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1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.[**See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.**]

1. Build mockup [**as indicated on Drawings**]<**Insert mockup requirements**>.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: [**Two**][**Five**][**10**]<**Insert number**> years from date of Substantial Completion.
b. Glazing Units: [**Five**][**10**]<**Insert number**> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design reinforcing mullions.

B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: FGIA or WDMA certified with label attached to each window.

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C. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: [R][LC][CW][As indicated on Drawings]<Insert class>.
2. Minimum Performance Grade: [15][20][25][30][35][40][45][50][As indicated on Drawings]<Insert grade>.
3. Mulled Window Systems: Evaluate and rate combination assemblies as single systems as determined by AAMA 450 in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements.

D. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:

a. Fixed Windows: Not more than [0.50 Btu/sq. ft. x h x deg F][0.45 Btu/sq. ft. x h x deg F][0.42 Btu/sq. ft. x h x deg F][0.36 Btu/sq. ft. x h x deg F][0.34 Btu/sq. ft. x h x deg F][0.29 Btu/sq. ft. x h x deg F][0.26 Btu/sq. ft. x h x deg F]<Insert value>.
b. Operable Windows: Not more than [0.62 Btu/sq. ft. x h x deg F][0.60 Btu/sq. ft. x h x deg F][0.54 Btu/sq. ft. x h x deg F][0.45 Btu/sq. ft. x h x deg F][0.42 Btu/sq. ft. x h x deg F][0.36 Btu/sq. ft. x h x deg F][0.32 Btu/sq. ft. x h x deg F]<Insert value>.

2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200.

a. Fixed Windows: Not more than [0.23][0.25][0.36][0.38][0.40]<Insert value>.
b. Operable Windows: Not more than [0.21][0.23][0.33][0.34][0.36]<Insert value> as determined in accordance with NFRC 200.

E. Outdoor-Indoor Transmission Class (OITC): Rated for not less than [22][26][30]<Insert rating> OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

F. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3] for [basic][enhanced] protection.

1. Large-Missile Test: For glazing located within [30 ft.]<Insert dimension> of grade.
2. Small-Missile Test: For glazing located more than [30 ft.]<Insert dimension> above grade.

2.2 VINYL WINDOWS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

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1. [All Seasons Architectural Windows Mfg., Inc.; All Seasons Commercial Division, Inc.]
2. [Gerkin Windows & Doors]
3. [Intus Windows]
4. [JELD-WEN, Inc.]
5. [MI Windows and Doors, LLC]
6. [Milgard Manufacturing, LLC]
7. [Pella Corporation]
8. [PGT Custom Windows + Doors; PGT Innovations (PGTI)]
9. [Ply-Gem]
10. [Quaker Windows Products Co.]
11. [Shwinco Architectural Products LLC]
12. [Simonton Windows, Inc.]
13. [Thermal Windows, Inc.]
14. [Thermo-Tech Windows and Doors LLC.]
15. [VPI Quality Windows, Inc.; JELD-WEN Holding, Inc.]
16. <Insert manufacturer's name>

B. Provide manufacturer's standard vinyl window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.

C. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: Project out.
2. Awning: Project out.
3. Single hung.
4. Double hung.
5. Horizontal sliding.
6. Fixed.

D. Frames and Sashes: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Finish: Integral color, [white][beige][sandstone]<Insert finish>.
2. Gypsum Board Returns: Provide at interior face of frame.

E. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.

1. Kind: Fully tempered [where indicated on Drawings]<Insert requirements>.

F. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C1172, with two plies of float glass.

1. Float Glass: [Annealed][Heat strengthened][Fully tempered][As required by performance requirements indicated].
2. Inner Ply: Clear.
3. Interlayer: [0.090 inch][As required by performance requirements indicated]<Insert requirements>.
4. Outer Ply: [Clear][Gray][Bronze][Green]<Insert tint>.

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5. Low-E Coating: [**Pyrolytic on second surface**][**Sputtered on second surface**][**Sputtered on third surface**][**Sputtered on second or third surface**]<**Insert coating**>.

G. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.

a. Tint: [**Clear**][**Gray**][**Bronze**][**Green**]<**Insert tint**>.
b. Kind: Fully tempered [**where indicated on Drawings**]<**Insert requirements**>.

2. Lites: [**Two**][**Three**].
3. Filling: Fill space between glass lites with [**air**][**argon**].
4. Low-E Coating: [**Pyrolytic on second surface**][**Sputtered on second surface**][**Sputtered on third surface**][**Sputtered on second or third surface**]<**Insert coating**>.
5. Integral Louver Blinds: Glass manufacturer's standard, horizontal louver blinds with aluminum slats and polyester fiber cords, located in space between glass lites, and operated by hardware located on inside face of sash.

a. Operation: [**Tilt only**][**Tilt, raising, and lowering**].
b. Color: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<**Insert color**>.

H. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190, with two lites and complying with impact-resistance requirements in "Performance Requirements" Article.

1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.

a. Tint: [**Clear**][**Gray**][**Bronze**][**Green**]<**Insert tint**>.
b. Kind: [**Heat strengthened**][**Fully tempered**].

2. Interior Lite: ASTM C1172, clear laminated glass with two plies of float glass.

a. Float Glass: [**Annealed**][**Heat strengthened**][**Fully tempered**][**As required by performance requirements indicated**].
b. Interlayer Thickness: [0.090 inch][**As required by performance requirements indicated**]<**Insert requirements**>.

3. Filling: Fill space between glass lites with [**air**][**argon**].
4. Low-E Coating: [**Pyrolytic on second surface**][**Sputtered on second surface**][**Sputtered on third surface**][**Sputtered on second or third surface**]<**Insert coating**>.

I. Glazing System: [**Manufacturer's standard factory-glazing system that produces weathertight seal**]<**Insert glazing requirements**>.

1. Dual Glazing System:

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a. Interior Lite: [**Glass**][**Insulating-glass unit**]<**Insert type**>.
b. Exterior Lite: [**Glass**][**Insulating-glass unit**]<**Insert type**>.

J. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<**Insert color and finish**>.

K. Projected Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.

a. Type and Style: [**Match Architect's sample**][**As selected by Architect from manufacturer's full range of types and styles**]<**Insert type and style**>.

2. Hinges: [**Manufacturer's standard type for sash weight and size indicated**][**Stainless-steel hinges with stainless-steel-reinforced, sliding nylon shoes**]<**Insert description**>.
3. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one arm on sashes up to 29 inches tall and two arms on taller sashes.
4. Limit Devices: [**Concealed friction adjustor, adjustable stay bar**][**Concealed support arms with adjustable, limited, hold-open**]<**Insert type**> limit devices designed to restrict sash opening.

a. Limit clear opening to [4 inches]<**Insert dimension**> for ventilation; with custodial key release.

5. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches above floor; one pole operator and pole hanger per room that has operable windows more than 72 inches above floor.

L. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.[**Provide custodial locks.**]
3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

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M. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: [**Extruded-aluminum track with natural anodized finish**][**Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color**][**Manufacturer's standard**]<**Insert track material and finish**> of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.[**Provide custodial locks.**]
3. Roller Assemblies: Low-friction design.

N. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

O. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

P. Mullions: Provide combination and reinforcing mullions and cover plates matching window units, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide reinforcing mullions and cover plates capable of withstanding design wind loads of window units.

2.3 ACCESSORIES

A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.

1. Quantity and Type: [**One permanently located between insulating-glass lites**][**Three per sash, one permanently located between insulating-glass lites, and two permanently attached to the interior and exterior lites**]<**Insert requirements**>.
2. Material: [**Manufacturer's standard**]<**Insert material**>.
3. Pattern: [**As indicated on Drawings**]<**Insert pattern**>.
4. Profile: [**As selected by Architect from manufacturer's full range**]<**Insert profile**>.
5. Color: [**As selected by Architect from manufacturer's full range**]<**Insert color**>.

2.4 FABRICATION

A. Fabricate vinyl windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze vinyl windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

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D. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant reinforcement.

E. Window Assemblies: [**Bow**][**Bay**][**Combination**]. Provide window units in configuration indicated on Drawings. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:

1. Combination and reinforcing mullions with interior and exterior trim.
2. Interior and exterior extension and trim.
3. Clear [**pine**]<**Insert species**> head and seat boards.
4. Top and bottom plywood platforms.
5. Support brackets.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Mullions: Install combination and reinforcing mullions for combination assemblies in accordance with manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner will engage**][**Engage**] a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows to take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance will be performed in accordance with AAMA 502.
2. Air-Infiltration Testing:

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a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
b. Allowable Air-Leakage Rate: [**1.5**]<**Insert number**> times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

a. Test Pressure: [**Two-thirds**]<**Insert number**> times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: [**One**][**Three**]<**Insert number or description**> window(s) of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows will be tested [**immediately after installation**][**at 5, 50, and 90 percent completion**]<**Insert test schedule**>.
5. Test Reports: Prepared in accordance with AAMA 502.

C. Test and Inspections:

1. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 085313

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinges.
2. Self-closing hinges and pivots.
3. Mortise locks.
4. Delayed-egress electromagnetic locks.
5. Surface closers.
6. Wall- and floor-mounted stops.
7. Thresholds.

B. Related Requirements:

1. [**Section 064100 "Architectural Wood Casework"**][**Section 064101 "Architectural Wood Casework (NAAWS Standard)"**] for cabinet door hardware provided with cabinets.
2. Section 081113 "Hollow Metal Doors and Frames" [**for astragals provided as part of labeled fire-rated assemblies**][**and**][**for door silencers provided as part of hollow-metal frames**].
3. Section 081119 "Stainless-Steel Doors and Frames" [**for astragals provided as part of labeled fire-rated assemblies**][**and**][**for door silencers provided as part of stainless steel frames**].
4. Section 081173 "Sliding Metal Fire Doors" for door and track preparation, reinforcement, and motorized operators provided as part of automatic-closing assemblies.
5. Section 081213 "Hollow Metal Frames" [**for astragals provided as part of labeled fire-rated assemblies**][**and**][**for door silencers provided as part of hollow-metal frames**].
6. Section 081216 "Aluminum Frames" for door silencers provided as part of aluminum frames.
7. Section 081316.13 "Aluminum Terrace Doors" for entrance door hardware, [**except**][**including**] cylinders.
8. Section 081416 "Flush Wood Doors" for [**astragals**][**and**][**integral intumescent seals**] provided as part of labeled fire-rated assemblies.
9. Section 081433 "Stile and Rail Wood Doors" for [**astragals**][**and**][**integral intumescent seals**] provided as part of labeled fire-rated assemblies.
10. Section 081713 "Integrated Metal Door Opening Assemblies" for door hardware provided as part of integrated metal door opening assemblies.
11. Section 083113 "Access Doors and Frames" for access door hardware, [**except**][**including**] cylinders.
12. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
13. Section 083326 "Overhead Coiling Grilles" for door hardware provided as part of

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overhead coiling grille assemblies.

14. [**Section 083473.13 "Metal Sound Control Door Assemblies"**][**and**][**Section 083473.16 "Wood Sound Control Door Assemblies"**] for hinges and gasketing provided as part of sound-rated door assemblies.
15. Section 083513 "Folding Doors" for pulls, latches, hinges, guides, and pivots provided as part of the folding door package.
16. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, [**except**][**including**] cylinders.
17. Section 084126 "All-Glass Entrances and Storefronts" for entrance door hardware, [**except**][**including**] cylinders.
18. Section 084229.13 "Folding Automatic Entrances" for entrance door hardware, [**except**][**including**] cylinders.
19. Section 084229.23 "Sliding Automatic Entrances" for entrance door hardware, [**except**][**including**] cylinders.
20. Section 084229.33 "Swinging Automatic Entrances" for entrance door hardware, [**except**][**including**] cylinders.
21. Section 084233 "Revolving Door Entrances" for revolving door entrance hardware, [**except**][**including**] cylinders.
22. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for entrance door hardware, [**except**][**including**] cylinders.
23. Section 087113 "Power Door Operators" for low-energy power operators and low-energy power-assist operators.
24. Section 102213 "Wire Mesh Partitions" for door hardware for doors in wire mesh partitions, [**except**][**including**] cylinders.
25. Section 102600 "Wall and Door Protection" for plastic door protection units that match wall protection units.
26. Section 119812 "Detention Doors and Frames" for door silencers provided as part of detention frames.
27. Section 119814 "Detention Door Hardware" for hardware for detention doors.
28. Section 133419 "Metal Building Systems" for door hardware, [**except**][**including**] cylinders.
29. Section 134900 "Radiation Protection" for lead-lined astragals provided as part of labeled fire-rated assemblies.
30. Section 281000 "Access Control" for coordination of access control system components.
31. Section 281400 "Access Control System Hardware" for access control system units, power, battery chargers, and computer equipment.
32. Section 283100 "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion-detection system.
33. [**Section 284600 "Fire Detection and Alarm"**][**and**][**Section 284614 "Single- and Multiple-Station Alarms"**] for connections to building fire alarm system.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Conference participants must include Installer's Architectural Hardware Consultant[**and Owner's security consultant**].

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B. Keying Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Conference participants must include Installer's Architectural Hardware Consultant[**and Owner's security consultant**].
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system, including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.
f. <**Insert requirements to suit Project**>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

D. Samples for Initial Selection: For each type of exposed finish.

E. Samples for Verification: For each type of exposed product, in each finish specified.

1. Sample Size: Full-size units or minimum **2-by-4-inch** Samples for sheet and **4-inch** long Samples for other products.

a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

F. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors,

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frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule [**after**][**or**][**concurrent with**] submissions of product data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format[**and use same door numbers**] as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

G. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [**Installer**][**and**][**Architectural Hardware Consultant**].

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

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1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final [door hardware][and][keying] schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as [a Door and Hardware Specification Consultant (DHSC)][an Architectural Hardware Consultant (AHC)][an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC)][an Architectural Opening Consultant (AOC)].

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: [Three]<Insert number> years from date of Substantial Completion unless otherwise indicated below:

a. Electromagnetic and Delayed-Egress Locks: [Five]<Insert number> years from date of Substantial Completion.
b. Exit Devices: [Two]<Insert number> years from date of Substantial Completion.
c. Manual Closers: [10]<Insert number> years from date of Substantial Completion.

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d. Concealed Floor Closers: [**Five**][**10**][**25**]<**Insert number**> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.

1. Air-Leakage Rate: Maximum air leakage of [0.3 cfm per sq. ft.]<**Insert rate**> at the tested pressure differential of [0.3 inch wg]<**Insert value**> of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with [**the USDOJ's "2010 ADA Standards for Accessible Design"**][**the DOT's "ADA Standards for Transportation Facilities"**][**the ABA standards of the Federal agency having jurisdiction**][**ICC A117.1**][**HUD's "Fair Housing Accessibility Guidelines"**][**and**]<**Insert regulation**>.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

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2.2 HINGES

A. Hinges: ANSI/BHMA A156.1.[**Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.**]

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Allegion plc**]
b. [**Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)**]
c. [**Bommer Industries, Inc**]
d. [**Cal-Royal Products, Inc**]
e. [**Design Hardware; Mesker Openings Group; dormakaba**]
f. [**Don-Jo Mfg., Inc**]
g. [**Hager Companies**]
h. [**INOX; Unison Hardware, Inc**]
i. [**Lawrence Hardware Inc.**]
j. [**McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY**]
k. [**PAMEX Inc.**]
l. [**PBB, Inc**]
m. [**STANLEY; dormakaba USA, Inc.**]
n. <**Insert manufacturer's name**>

2.3 SELF-CLOSING HINGES AND PIVOTS

A. Self-Closing Hinges and Pivots: ANSI/BHMA A156.17.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Allegion plc**]
b. [**Bommer Industries, Inc**]
c. [**Cal-Royal Products, Inc**]
d. [**Design Hardware; Mesker Openings Group; dormakaba**]
e. [**Don-Jo Mfg., Inc**]
f. [**Hager Companies**]
g. [**McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY**]
h. [**PBB, Inc**]
i. [**STANLEY; dormakaba USA, Inc.**]
j. <**Insert manufacturer's name**>

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2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum [1-inch][1.25-inch]<**Insert dimension**> bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: [**As indicated on Drawings**]<**Insert description or manufacturer's design designation**>.
2. Levers: [**Wrought**][**Forged**][**Cast**].
    a. <**Insert model number and description**>.
3. Escutcheons (Roses): [**Wrought**][**Forged**][**Cast**].
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Mortise Locks: ANSI/BHMA A156.13, [**Operational Grade 1**][**Security Grade 1**][**Operational Grade 2**][**Security Grade 2**]; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
    a. [**Accurate Lock & Hardware Co.**]
    b. [**Adams Rite Manufacturing Company, an ASSA ABLOY Group company**]
    c. [**Allegion plc**]
    d. [**Arrow USA; an ASSA ABLOY Group company**]
    e. [**BEST Access Solutions, Inc.; dormakaba USA Inc.**]
    f. [**Cal-Royal Products, Inc**]
    g. [**Corbin Russwin, Inc.; an ASSA ABLOY Group company**]

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h. [Design Hardware; Mesker Openings Group; dormakaba]
i. [dormakaba USA Inc.]
j. [Hager Companies]
k. [INOX; Unison Hardware, Inc]
l. [Lawrence Hardware Inc.]
m. [Marks USA; Napco Security Technologies, Inc.]
n. [RR Brink Locking Systems, Inc.]
o. [SARGENT Manufacturing Company; ASSA ABLOY]
p. [STANLEY; dormakaba USA, Inc.]
q. [Yale Security Inc; ASSA ABLOY]
r. <Insert manufacturer's name>

2.5 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: ANSI/BHMA A156.3; consisting of active-leaf, hold-open lever, and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release[; and with internal override].

B. Carry-Open Bars: ANSI/BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

C. Astragals: ANSI/BHMA A156.22.

2.6 SURFACE CLOSERS

A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [Allegion plc]
b. [Arrow USA; an ASSA ABLOY Group company]
c. [Cal-Royal Products, Inc]
d. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
e. [Design Hardware; Mesker Openings Group; dormakaba]
f. [dormakaba USA Inc.]
g. [Hager Companies]
h. [INOX; Unison Hardware, Inc]
i. [Norton Door Controls; ASSA ABLOY]
j. [PAMEX Inc.]
k. [Rixson Specialty Door Controls; ASSA ABLOY]
l. [SARGENT Manufacturing Company; ASSA ABLOY]

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m. [STANLEY; dormakaba USA, Inc.]
n. [Yale Security Inc; ASSA ABLOY]
o. <Insert manufacturer's name>

2.7 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [Allegion plc]
b. [Architectural Builders Hardware Mfg., Inc]
c. [ASI-American Specialties, Inc.]
d. [Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
e. [Burns Manufacturing Incorporated]
f. [Cal-Royal Products, Inc]
g. [Don-Jo Mfg., Inc]
h. [Door Controls International]
i. [Hager Companies]
j. [Hiawatha, Inc; a division of the Activar Construction Products Group]
k. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
l. [Trimco]
m. <Insert manufacturer's name>

2.8 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [Hager Companies]
b. [Legacy Manufacturing]
c. [M-D Building Products, Inc]
d. [National Guard Products, Inc]
e. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
f. [Reese Enterprises, Inc]
g. [Rixson Specialty Door Controls; ASSA ABLOY]
h. [Sealeze]
i. [Zero International; Allegion plc]
j. <Insert manufacturer's name>

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2.9 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames[; use threaded-to-the-head wood screws for wood doors and frames].
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.10 FINISHES

A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a

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strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOOR HARDWARE

A. Mounting Heights: Mount door hardware units at heights [**indicated on Drawings**][**to comply with the following**] unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as [**indicated in keying schedule**][**directed by Owner**].
2. Furnish permanent cores to Owner for installation.

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F. Key Control System:

1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
3. Key Control System Software: Set up multiple-index system based on final keying schedule.

G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, [**above accessible ceilings**][**in equipment room**]. Verify location with Architect.

1. Configuration: Provide [**one power supply for each door opening**][**least number of power supplies required to adequately serve doors**] with electrified door hardware.

H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: [**Owner will engage**][**Engage**] a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.3 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service is to

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include [six][nine][12]<Insert number> months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

3.4 DEMONSTRATION

A. [Engage Installer to train][Train] Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.5 DOOR HARDWARE SCHEDULE

A. Hardware Set 1: Each door to have the following:

1. <Insert hardware type>.

END OF SECTION 087100

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SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 088000 "Glazing" for glass with reflective coatings used for vision and spandrel lites.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches long.

D. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of mirror[**and mirror mastic**].

B. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

C. Qualification Statements: For Installer.

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D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer, who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: [**Five**]<**Insert number**> years from date of [**Substantial Completion**][**manufacture**].

PART 2 - PRODUCTS

2.1 MIRROR HARDWARE

A. Mirror Bottom Clips: [**As indicated**]<**Insert description and finish or product designation and manufacturer's name**>.

B. Mirror Top Clips: [**As indicated**]<**Insert description and finish or product designation and**

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manufacturer's name>.

C. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.

1. Profile: As indicated.
2. Finish: <Insert manufacturer's finish designation and name>.

D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

E. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.2 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: [Flat polished][Rounded polished][Flat high polished][Rounded high polished][Beveled polished edge of width shown].

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 INSTALLATION OF MIRRORS

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. NGA Publications: ["Laminated Glazing Reference Manual,"]"Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

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C. Install mirrors with [**mastic and**]mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Aluminum J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
3. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips [**where indicated**][**so they are symmetrically placed and evenly spaced**].
4. Install mastic as follows:

    a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

END OF SECTION 088300

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SECTION 090190.52 - MAINTENANCE REPAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes maintenance repainting as follows:

1. Removing existing paint.
2. Patching substrates.
3. Repainting[, **including staining and varnishing of wood**].

B. Related Requirements:

1. Section 013516 "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.
2. Section 040110 "Masonry Cleaning" for cleaning and removing paint from masonry.
3. Section 050170.51 "Decorative Metal Cleaning" for cleaning and removing paint from decorative metal.
4. Section 099113 "Exterior Painting," Section 099123 "Interior Painting," Section 099300 "Staining and Transparent Finishing," and Section 099600 "High-Performance Coatings" for paint materials and systems for new construction.
5. Section 099423 "Gilding" for gilding surfaces.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for product application and use.
2. Include test data substantiating that products comply with requirements.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.

C. Samples: For each type of paint system and each pattern, color, and gloss; [**in sizes indicated below**][**minimum 6 inches long in least dimension, but not less than whole pattern**].

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1. Include stepped Samples defining each separate coat, including fillers and primers. Resubmit until each required sheen, color, and texture is achieved.
2. For each painted color being matched to a standardized color-coding system, include the color chips from the color-coding-system company with Samples.
3. Include a list of materials for each coat of each Sample.
4. Label each Sample for location and application.
5. Sample Size:

    a. Painted Surfaces: [4-by-8-inch]<**Insert dimensions**> Samples for each color and material, on hardboard.
    b. Stained or Natural Wood: [12-by-12-inch]<**Insert dimensions**> Samples of natural- or stained-wood finish, on representative <**Insert required species of wood**> surfaces.

D. Product List: For each paint product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each MPI-product category specified in paint systems, with the proposed product highlighted.
3. VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. Color Matching Certificate: For computer-matched colors.

B. Preconstruction Test Reports: For cleaning materials, [**paint removers**][**and**][**paint coatings and systems**].

1.5 QUALITY ASSURANCE

A. Color Matching: Custom computer-match paint colors to colors indicated [**in maintenance repainting schedule(s) at the end of Part 3**][**on Drawings**]<**Insert requirement**>.[**For colors indicated by a standardized coding system, obtain a color chip for each color indicated from the color-coding-system company; computer match paint colors to the color chips.**]

B. Mockups: Prepare mockups of maintenance repainting processes for each type of coating system and substrate indicated and each color and finish required to demonstrate aesthetic effects and to set quality standards for materials and execution. Duplicate appearance of approved Sample submittals.

1. Locate mockups [**on existing surfaces where directed by Architect**][**in locations that enable viewing under same conditions as the completed Work**]<**Insert requirement**>.
2. Surface-Preparation Mockups: On existing surfaces using applicable specified methods of cleaning and other surface preparation, provide mockup sample of at least [100 sq. ft.]<**Insert dimension**>.
3. Coating Mockups: [**Two**]<**Insert number**> surfaces of at least [100 sq. ft.]<**Insert**

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dimension> to represent surfaces and conditions for application of each type of coating system under same conditions as the completed Work.

4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing of cleaning materials, [paint removers][and][compatibility of paint coatings and systems] for each[indicated] type of painted surface.

1. Use test areas as indicated and representative of proposed materials and existing construction.
2. Propose changes to materials and methods to suit Project.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with maintenance repainting only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

B. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer for surface preparation and during paint application and drying periods.

PART 2 - PRODUCTS

2.1 PREPARATORY CLEANING MATERIALS

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 to 160 deg F.

C. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for every 5 gal. of solution

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required.

D. Mildewcide: Commercial proprietary mildewcide or a job-mixed solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

E. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.

F. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: [**As indicated with each paint system in maintenance repainting schedule(s) at the end of Part 3**][**Match Architect's samples**][**As selected by Architect from full range of industry colors**]<**Insert requirement**>.

2.3 PAINT MATERIALS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Emissions and Pollutant Control: Not less than 85 percent of field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:

1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
2. VOC content shall not exceed limits of authorities having jurisdiction and the following:

    a. Flat Coatings: 50 g/L.
    b. Nonflat Coatings: 100 g/L.
    c. Nonflat - High-Gloss Coatings: 150 g/L.
    d. Concrete/Masonry Sealers: 100 g/L.
    e. Dry-Fog Coatings: 150 g/L.
    f. Floor Coatings: 100 g/L.

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g. Industrial Maintenance Coatings: 250 g/L.
h. Low-Solids Coatings: 120 g/L.
i. Mastic Texture Coatings: 100 g/L.
j. Metallic Pigmented Coatings: 500 g/L.
k. Pretreatment Wash Primers: 420 g/L.
l. Primers, Sealers, and Undercoaters: 100 g/L.
m. Reactive Penetrating Sealers: 350 g/L.
n. Recycled Coatings: 250 g/L.
o. Rust-Preventive Coatings: 250 g/L.

C. Transition Coat: Paint manufacturer's recommended coating for use where a residual existing coating is incompatible with the paint system.

PART 3 - EXECUTION

3.1 MAINTENANCE REPAINTING, GENERAL

A. Maintenance Repainting Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from building interior at [5 feet][10 feet]<Insert distance> away from painted surface and from building exterior at [20 feet][50 feet]<Insert distance> away from painted surface.

B. Execution of the Work: In repainting surfaces, disturb them as minimally as possible and as follows:

1. Remove failed coatings and corrosion and repaint.
2. Verify that substrate surface conditions are suitable for repainting.
3. Allow other trades to repair items in place before repainting.

C. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail.

D. Heat Processes: Do not use torches, heat guns, or heat plates.

3.2 PAINT APPLICATION, GENERAL

A. Comply with manufacturers' written instructions for application methods unless otherwise indicated in this Section.

B. Prepare surfaces to be painted according to the Surface-Preparation Schedule and with manufacturer's written instructions for each substrate condition.

C. Apply a transition coat over incompatible existing coatings.

D. Metal Substrate: Stripe paint corners, crevices, bolts, welds, and sharp edges before applying full coat. Apply two coats to surfaces that are inaccessible after completion of the Work. Tint stripe coat different than the main coating and apply with brush.

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E. Blending Painted Surfaces: When painting new substrates patched into existing surfaces or touching up missing or damaged finishes, apply coating system specified for the specific substrate. Apply final finish coat over entire surface from edge to edge and corner to corner.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage paint-remover manufacturer's factory-authorized service representative for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.

B. Paint Material Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for composition and dry film thickness.

1. Paint Composition: The following procedure may be performed at any time and as often as Owner deems necessary during the period when paints are being applied:

   a. Testing agency will sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   b. Testing agency will perform tests for compliance of paint materials with product requirements.
   c. If test results show materials being used do not comply with product requirements, Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

2. Dry Film Thickness:

   a. Contractor shall touch up and restore painted surfaces damaged by testing.
   b. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.4 SURFACE-PREPARATION SCHEDULE

A. General: Before painting, prepare surfaces[**where indicated on Drawings**] for painting according to applicable requirements specified in this schedule.

1. Examine surfaces to evaluate each surface condition according to paragraphs below.
2. Where existing degree of soiling prevents examination, preclean surface and allow it to dry before making an evaluation.
3. Repair substrate defects according to "Substrate Repair" Article.

B. Surface Preparation for [**MPI DSD 0**]<**Insert designation**> Degree of Surface

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Degradation:

1. Surface Condition: Existing paint film in good condition and tightly adhered.
2. Paint Removal: Not required.
3. Preparation for Painting: Wash surface by detergent cleaning; use solvent cleaning where needed. Roughen or degloss cleaned surfaces to ensure paint adhesion according to paint manufacturer's written instructions.

C. Surface Preparation for [**MPI DSD 1**]<**Insert designation**> Degree of Surface Degradation:

1. Surface Condition: Paint film cracked or broken but adhered.
2. Paint Removal: Scrape by hand-tool cleaning methods to remove loose paint until only tightly adhered paint remains.
3. Preparation for Painting: Wash surface by detergent cleaning; use other cleaning methods for small areas of bare substrate if required. Roughen, degloss, and sand the cleaned surfaces to ensure paint adhesion and a smooth finish according to paint manufacturer's written instructions.

D. Surface Preparation for [**MPI DSD 2**]<**Insert designation**> Degree of Surface Degradation:

1. Surface Condition: Paint film loose, flaking, or peeling.
2. Paint Removal: Remove loose, flaking, or peeling paint film by hand-tool or chemical paint-removal methods.
3. Preparation for Painting: Wash surface by detergent cleaning; use solvent cleaning where needed. Use other cleaning methods for small areas of bare substrate if required. Sand surfaces to smooth remaining paint film edges. Prepare bare cleaned surface to be painted according to paint manufacturer's written instructions for substrate construction materials.

E. Surface Preparation for [**MPI DSD 3**]<**Insert designation**> Degree of Surface Degradation:

1. Surface Condition: Paint film [**severely deteriorated**][**obscuring fine architectural detail work because of paint-layer buildup**][**and**][**surface indicated to have paint completely removed**].
2. Paint Removal: Completely remove paint film by hand-tool or chemical paint-removal methods. Remove rust.
3. Preparation for Painting: Prepare bare cleaned surface according to paint manufacturer's written instructions for substrate construction materials.

F. Surface Preparation for [**MPI DSD 4**]<**Insert designation**> Degree of Surface Degradation:

1. Surface Condition: Missing material, small holes and openings, and deteriorated or corroded substrate.
2. Substrate Preparation: Repair, replace, and treat substrate according to "Substrate Repair" Article[**and requirements in other Specification Sections**].
3. Preparation for Painting: Sand substrate surfaces to smooth remaining paint film edges and prepare according to paint manufacturer's written instructions for

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substrate construction materials. Remove rust.

4. Painting: Paint as required for [MPI DSD 2]<Insert designation> degree of surface degradation.

3.5 EXTERIOR MAINTENANCE REPAINTING SCHEDULE

A. Ferrous Metal Substrates: [Iron railing and gate]<Insert item description or drawing designation, or both>:

1. Alkyd System: [MPI REX 5.1D]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Metal, Surface Tolerant[, MPI #23].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Metal, Surface Tolerant[, MPI #23].

b. Intermediate Coat: [Alkyd, exterior, matching topcoat]<Insert requirement or coating designation>.

c. Topcoat:

1) Alkyd, exterior, semigloss (Gloss Level 5)[, MPI #94].
2) Alkyd, exterior, gloss (Gloss Level 6)[, MPI #9].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

2. High-Performance, Pigmented-Polyurethane-over-Epoxy System: [MPI REX 5.1H]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Epoxy, Anti-Corrosive, for Metal[, MPI #101].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Epoxy, Anti-Corrosive, for Metal[, MPI #101].

b. Intermediate Coat in Primed Areas: Epoxy, High Build, Low Gloss[, MPI #108].

c. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6)[, MPI #72].

d. Second Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss

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Level 6)[, MPI #72].

e. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

B. Wood [Columns][Beams][Ceilings][Siding][and][Fencing]<Insert item description or drawing designation, or both>:

1. Latex System: [MPI REX 6.2A]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Alkyd for Exterior Wood[, MPI #5].
3) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Latex for Exterior Wood[, MPI #6].
4) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Alkyd for Exterior Wood[, MPI #5].
5) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Latex for Exterior Wood[, MPI #6].

b. Intermediate Coat: [Latex, exterior, matching topcoat]<Insert requirement or coating designation>.

c. Topcoat:

1) Latex, exterior flat (Gloss Levels 1-2)[, MPI #10].
2) Latex, exterior, low sheen (Gloss Levels 3-4)[, MPI #15].
3) Latex, exterior semigloss (Gloss Level 5)[, MPI #11].
4) Latex, exterior gloss (Gloss Level 6)[, MPI #119].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

2. Alkyd System: [MPI REX 6.2C]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Alkyd for Exterior Wood[, MPI #5].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Alkyd for Exterior Wood[, MPI #5].

b. Intermediate Coat: [Latex, exterior, matching topcoat]<Insert requirement or coating designation>.

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c. Topcoat:

1) Alkyd, exterior flat (Gloss Level 1)[, MPI #8].
2) Alkyd, exterior semigloss (Gloss Level 5)[, MPI #94].
3) Alkyd, exterior gloss (Gloss Level 6)[, MPI #9].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

C. Wood [Doors][Windows][Frames][Casings][and][Smooth Fasciae]<Insert item description or drawing designation, or both>:

1. Latex System: [MPI REX 6.3A]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Alkyd for Exterior Wood[, MPI #5].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Alkyd for Exterior Wood[, MPI #5].

b. Intermediate Coat: [Latex, exterior, matching topcoat]<Insert requirement or coating designation>.

c. Topcoat:

1) Latex, exterior flat (Gloss Levels 1-2)[, MPI #10].
2) Latex, exterior, low sheen (Gloss Levels 3-4)[, MPI #15].
3) Latex, exterior semigloss (Gloss Level 5)[, MPI #11].
4) Latex, exterior gloss (Gloss Level 6)[, MPI #119].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

2. Alkyd System: [MPI REX 6.3B]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Alkyd for Exterior Wood[, MPI #5].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Alkyd for Exterior Wood[, MPI #5].

b. Intermediate Coat: [Alkyd, exterior, matching topcoat]<Insert requirement

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or coating designation>.

c. Topcoat:

1) Alkyd, exterior flat (Gloss Level 1)[, MPI #8].
2) Alkyd, exterior semigloss (Gloss Level 5)[, MPI #94].
3) Alkyd, exterior gloss (Gloss Level 6)[, MPI #9].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

3. Varnish System (Clear): [MPI REX 6.3F]<Insert system description>.

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with topcoat.
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with topcoat.

b. Intermediate Coat: [Exterior varnish matching topcoat]<Insert requirement or coating designation>.

c. Topcoat:

1) Varnish, with UV inhibitor, exterior, semigloss (Gloss Level 5)[, MPI #30].
2) Varnish, with UV inhibitor, exterior, gloss (Gloss Level 6)[, MPI #29].
3) Varnish, marine spar, exterior, gloss (Gloss Level 6)[, MPI #28].

D. Wood [Deck][and][Stairs]<Insert item description or drawing designation, or both>:

1. Latex Porch and Floor System over Alkyd Primer: [MPI REX 6.5A]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Alkyd/Oil for Exterior Wood[, MPI #5].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Alkyd/Oil for Exterior Wood[, MPI #5].

b. Intermediate Coat: [Floor Paint, Latex, matching topcoat]<Insert requirement or coating designation>.

c. Topcoat:

1) Floor paint, latex, low gloss[, MPI #60].
2) Floor paint, latex, gloss[, MPI #68].

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d. Topcoat Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
e. Color: Match [**Munsell Color 10 G 8/2**][**Plochere Color System #8da399**][**existing colors**][**colors indicated on Drawings**]<**Insert color(s) or requirement**>.

2. Alkyd Floor Enamel System: [**MPI REX 6.5B**]<**Insert system description**> system[**over a transition coat**].

a. Prime Coat:

1) For [**MPI DSD 1**]<**Insert designation**> degree of surface degradation, touch up with topcoat.
2) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation, spot prime with topcoat.
3) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with topcoat.

b. Intermediate Coat: [**Floor enamel matching topcoat**]<**Insert requirement or coating designation**>.
c. Topcoat:

1) Floor paint, alkyd, low gloss[**, MPI #59**].
2) Floor enamel, alkyd, gloss (Gloss Level 6)[**, MPI #27**].

d. Topcoat Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
e. Color: Match [**Munsell Color 10 G 8/2**][**Plochere Color System #8da399**][**existing colors**][**colors indicated on Drawings**]<**Insert color(s) or requirement**>.

E. Wood [**Shingle**][**Shake**] Siding <**Insert item description or drawing designation, or both**>:

1. Latex System: [**MPI REX 6.6A**]<**Insert system description**> system[**over a transition coat**].

a. Prime Coat:

1) For [**MPI DSD 1**]<**Insert designation**> degree of surface degradation, touch up with topcoat.
2) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation, spot prime with Primer, Alkyd for Exterior Wood[**, MPI #5**].
3) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with Primer, Alkyd for Exterior Wood[**, MPI #5**].

b. Intermediate Coat: [**Latex, exterior, matching topcoat**]<**Insert requirement or coating designation**>.
c. Topcoat:

1) Latex, exterior flat (Gloss Levels 1-2)[**, MPI #10**].

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2) Latex, exterior, low sheen (Gloss Levels 3-4)[, MPI #15].
3) Latex, exterior semigloss (Gloss Level 5)[, MPI #11].
4) Latex, exterior gloss (Gloss Level 6)[, MPI #119].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

2. Alkyd System: [MPI REX 6.6B]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Alkyd for Exterior Wood[, MPI #5].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Alkyd for Exterior Wood[, MPI #5].

b. Intermediate Coat: [Latex, exterior, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Alkyd, exterior flat (Gloss Level 1)[, MPI #8].
2) Alkyd, exterior semigloss (Gloss Level 5)[, MPI #94].
3) Alkyd, exterior gloss (Gloss Level 6)[, MPI #9].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

3.6 INTERIOR MAINTENANCE REPAINTING SCHEDULE

A. Ferrous Metal Substrates: [Iron railing]<Insert item description or drawing designation, or both>:

1. Latex System: [MPI RIN 5.1N]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Metal, Surface Tolerant[, MPI #23].
3) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Alkyd, Anti-Corrosive for Metal[, MPI #79].
4) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Rust-Inhibitive, Water Based[, MPI #107].

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5) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Metal, Surface Tolerant[, MPI #23].
6) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Alkyd, Anti-Corrosive for Metal[, MPI #79].
7) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Rust-Inhibitive, Water Based[, MPI #107].

b. Intermediate Coat: [Latex matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Latex, interior, flat (Gloss Level 1)[, MPI #53].
2) Latex, interior (Gloss Level 2)[, MPI #44].
3) Latex, interior (Gloss Level 3)[, MPI #52].
4) Latex, interior (Gloss Level 4)[, MPI #43].
5) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].
6) Latex, interior, gloss (Gloss Level 6)[, MPI #114].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

2. Alkyd System: [MPI RIN 5.1E]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Metal, Surface Tolerant[, MPI #23].
3) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Alkyd, Anti-Corrosive for Metal[, MPI #79].
4) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Metal, Surface Tolerant[, MPI #23].
5) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Alkyd, Anti-Corrosive for Metal[, MPI #79].

b. Intermediate Coat: [Alkyd, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Alkyd, interior, flat (Gloss Level 1)[, MPI #49].
2) Alkyd, interior (Gloss Level 3)[, MPI #51].
3) Alkyd, interior, semigloss (Gloss Level 5)[, MPI #47].
4) Alkyd, interior, gloss (Gloss Level 6)[, MPI #48].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System

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#8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

3. High-Performance, Pigmented-Polyurethane-over-Epoxy System: [MPI RIN 5.1H]<Insert system description> system[over a transition coat].

   a. Prime Coat:

      1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with Epoxy, Gloss[, MPI #77].
      2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Zinc Rich, Organic[, MPI #18].
      3) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Zinc Rich, Epoxy[, MPI #20].
      4) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Zinc Rich, Organic[, MPI #18].
      5) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Zinc Rich, Epoxy[, MPI #20].

   b. Intermediate Coat in Primed Areas: Epoxy, Gloss[, MPI #77].
   c. Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6)[, MPI #72].
   d. Second Topcoat: Polyurethane, two-component, pigmented, gloss (Gloss Level 6)[, MPI #72].
   e. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

B. Wood [Columns][Beams][and][Ceilings]<Insert item description or drawing designation, or both>:

   1. Latex System over Latex Primer: [MPI RIN 6.2D]<Insert system description> system[over a transition coat].

      a. Prime Coat:

         1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
         2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Latex, for Interior Wood[, MPI #39].
         3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Latex, for Interior Wood[, MPI #39].

      b. Intermediate Coat: [Latex, interior, matching topcoat]<Insert requirement or coating designation>.
      c. Topcoat:

         1) Latex, interior flat (Gloss Level 1)[, MPI #53].
         2) Latex, interior (Gloss Level 2)[, MPI #44].
         3) Latex, interior (Gloss Level 3)[, MPI #52].
         4) Latex, interior (Gloss Level 4)[, MPI #43].

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5) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].
6) Latex, interior, gloss (Gloss Level 6)[, MPI #114].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

2. Latex System over Alkyd Primer: [MPI RIN 6.2A]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Undercoat, Enamel, Interior[, MPI #46].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Undercoat, Enamel, Interior[, MPI #46].

b. Intermediate Coat: [Latex, interior, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Latex, interior flat (Gloss Level 1)[, MPI #53].
2) Latex, interior (Gloss Level 2)[, MPI #44].
3) Latex, interior (Gloss Level 3)[, MPI #52].
4) Latex, interior (Gloss Level 4)[, MPI #43].
5) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].
6) Latex, interior, gloss (Gloss Level 6)[, MPI #114].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

3. Alkyd System: [MPI RIN 6.2C]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Undercoat, Enamel, Interior[, MPI #46].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Undercoat, Enamel, Interior[, MPI #46].

b. Intermediate Coat: [Alkyd, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Alkyd, interior, flat (Gloss Level 1)[, MPI #49].

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2) Alkyd, interior (Gloss Level 3)[, MPI #51].
3) Alkyd, interior, semigloss (Gloss Level 5)[, MPI #47].
4) Alkyd, interior, gloss (Gloss Level 6)[, MPI #48].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

C. Wood [Doors][Windows][Frames][and][Moldings]<Insert item description or drawing designation, or both>:

1. Latex System over Latex Primer: [MPI RIN 6.3U]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Latex, for Interior Wood[, MPI #39].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Latex, for Interior Wood[, MPI #39].

b. Intermediate Coat: [Latex, interior, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].
2) Latex, interior, gloss (Gloss Level 6)[, MPI #114].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

2. Low-Odor Latex System over Latex Primer: [MPI RIN 6.3V]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Latex, for Interior Wood[, MPI #39].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Latex, for Interior Wood[, MPI #39].

b. Intermediate Coat: [Latex, interior, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Latex, interior, institutional low odor/VOC flat (Gloss Level 1)[, MPI

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#143].
2) Latex, interior, institutional low odor/VOC (Gloss Level 2)[, MPI #144].
3) Latex, interior, institutional low odor/VOC (Gloss Level 3)[, MPI #145].
4) Latex, interior, institutional low odor/VOC (Gloss Level 4)[, MPI #146].
5) Latex, interior, institutional low odor/VOC, semigloss (Gloss Level 5)[, MPI #147].
6) Latex, interior, institutional low odor/VOC, gloss (Gloss Level 6)[, MPI #148].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

3. Latex System over Alkyd Primer: [MPI RIN 6.3A]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Undercoat, Enamel, Interior[, MPI #46].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Undercoat, Enamel, Interior[, MPI #46].

b. Intermediate Coat: [Latex, interior, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].
2) Latex, interior, gloss (Gloss Level 6)[, MPI #114].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

4. Alkyd System: [MPI RIN 6.3B]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Undercoat, Enamel, Interior[, MPI #46].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Undercoat, Enamel, Interior[, MPI #46].

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b. Intermediate Coat: [Alkyd, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Alkyd, interior, semigloss (Gloss Level 5)[, MPI #47].
2) Alkyd, interior, gloss (Gloss Level 6)[, MPI #48].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

5. Alkyd Varnish System (Clear): [MPI RIN 6.3J]<Insert system description>.

a. Prime Coat:
b. For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.

1) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Shellac[, MPI #88].
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Alkyd, Sanding Sealer, Clear[, MPI #102].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Shellac[, MPI #88].
4) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Alkyd, Sanding Sealer, Clear[, MPI #102].

c. Intermediate Coat: [Interior varnish matching topcoat]<Insert requirement or coating designation>.
d. Topcoat:

1) Varnish, interior, flat (Gloss Level 1)[, MPI #73].
2) Varnish, interior, semigloss (Gloss Level 5)[, MPI #74].
3) Varnish, interior, gloss (Gloss Level 6)[, MPI #75].

D. Wood [Paneling][Casework][and][Millwork]<Insert item description or drawing designation, or both>:

1. Latex System over Latex Primer: [MPI RIN 6.4T]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Latex, for Interior Wood[, MPI #39].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Latex, for Interior Wood[, MPI #39].

b. Intermediate Coat: [Latex, interior, matching topcoat]<Insert requirement or coating designation>.

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c. Topcoat:

1) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].
2) Latex, interior, gloss (Gloss Level 6)[, MPI #114].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

2. Low-Odor Latex System over Latex Primer: [MPI RIN 6.4D]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Latex, for Interior Wood[, MPI #39].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Latex, for Interior Wood[, MPI #39].

b. Intermediate Coat: [Latex, interior, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Latex, interior, institutional low odor/VOC flat (Gloss Level 1)[, MPI #143].
2) Latex, interior, institutional low odor/VOC (Gloss Level 2)[, MPI #144].
3) Latex, interior, institutional low odor/VOC (Gloss Level 3)[, MPI #145].
4) Latex, interior, institutional low odor/VOC (Gloss Level 4)[, MPI #146].
5) Latex, interior, institutional low odor/VOC, semigloss (Gloss Level 5)[, MPI #147].
6) Latex, interior, institutional low odor/VOC, gloss (Gloss Level 6)[, MPI #148].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

3. Latex System over Alkyd Primer: [MPI RIN 6.4A]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Undercoat, Enamel, Interior[, MPI #46].

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3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Undercoat, Enamel, Interior[, MPI #46].

b. Intermediate Coat: [Latex, interior, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Latex, interior flat (Gloss Level 1)[, MPI #53].
2) Latex, interior (Gloss Level 2)[, MPI #44].
3) Latex, interior (Gloss Level 3)[, MPI #52].
4) Latex, interior (Gloss Level 4)[, MPI #43].
5) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].
6) Latex, interior, gloss (Gloss Level 6)[, MPI #114].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

4. Alkyd System: [MPI RIN 6.4C]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Undercoat, Enamel, Interior[, MPI #46].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Undercoat, Enamel, Interior[, MPI #46].

b. Intermediate Coat: [Alkyd, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Alkyd, interior flat (Gloss Level 1)[, MPI #49].
2) Alkyd, interior (Gloss Level 3)[, MPI #51].
3) Alkyd, interior, semigloss (Gloss Level 5)[, MPI #47].
4) Alkyd, interior, gloss (Gloss Level 6)[, MPI #48].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

5. Alkyd Varnish System over Stain: [MPI RIN 6.4F]<Insert system description>.

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Stain, Semi-Transparent, for Interior Wood[, MPI

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#90].

3) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with Stain, Semi-Transparent, for Interior Wood[**, MPI #90**].

b. Intermediate Coat: [**Interior varnish matching topcoat**]<**Insert requirement or coating designation**>.

c. Topcoat:

1) Varnish, interior, flat (Gloss Level 1)[**, MPI #73**].
2) Varnish, interior, semigloss (Gloss Level 5)[**, MPI #74**].
3) Varnish, interior, gloss (Gloss Level 6)[**, MPI #75**].

d. Stain Color: Match [**adjacent, cleaned wood of same type**][**existing color**][**color indicated on Drawings**]<**Insert color or requirement**>.

E. Wood [**Floors**][**and**][**Stairs**]<**Insert item description or drawing designation, or both**>:

1. Latex Porch and Floor System over Alkyd Primer: [**MPI RIN 6.5J**]<**Insert system description**> system[**over a transition coat**].

a. Prime Coat:

1) For [**MPI DSD 1**]<**Insert designation**> degree of surface degradation, touch up with topcoat.
2) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation, spot prime with Primer Sealer, Alkyd, Interior[**, MPI #45**].
3) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with Primer Sealer, Alkyd, Interior[**, MPI #45**].

b. Intermediate Coat: [**Floor Paint, Latex, matching topcoat**]<**Insert requirement or coating designation**>.

c. Topcoat:

1) Floor paint, latex, low gloss[**, MPI #60**].
2) Floor paint, latex, gloss[**, MPI #68**].

d. Topcoat Additive: Manufacturer's standard additive to increase skid resistance of painted surface.

e. Color: Match [**Munsell Color 10 G 8/2**][**Plochere Color System #8da399**][**existing colors**][**colors indicated on Drawings**]<**Insert color(s) or requirement**>.

2. Alkyd Floor Enamel System: [**MPI RIN 6.5A**]<**Insert system description**> system[**over a transition coat**].

a. Prime Coat:

1) For [**MPI DSD 1**]<**Insert designation**> degree of surface degradation, touch up with topcoat.
2) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation,

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spot prime with topcoat.
3) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with topcoat.

b. Intermediate Coat: [**Floor enamel matching topcoat**]<**Insert requirement or coating designation**>.
c. Topcoat:

1) Floor paint, alkyd, low gloss[**, MPI #59**].
2) Floor enamel, alkyd, gloss (Gloss Level 6)[**, MPI #27**].

d. Topcoat Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
e. Color: Match [**Munsell Color 10 G 8/2**][**Plochere Color System #8da399**][**existing colors**][**colors indicated on Drawings**]<**Insert color(s) or requirement**>.

3. Polyurethane Varnish System (Clear): [**MPI RIN 6.5C**]<**Insert system description**>.

a. Prime Coat:

1) For [**MPI DSD 1**]<**Insert designation**> degree of surface degradation, touch up with topcoat.
2) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation, spot prime with topcoat.
3) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with topcoat.

b. Intermediate Coat: [**Interior varnish matching topcoat**]<**Insert requirement or coating designation**>.
c. Topcoat: Varnish, interior, polyurethane, oil modified, gloss[**, MPI #56**].

4. Two-Component Aliphatic Polyurethane System (Clear): [**MPI RIN 6.5G**]<**Insert system description**>.

a. Prime Coat:

1) For [**MPI DSD 1**]<**Insert designation**> degree of surface degradation, touch up with topcoat.
2) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation, spot prime with topcoat.
3) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with topcoat.

b. Intermediate Coat: [**Aliphatic polyurethane varnish matching topcoat**]<**Insert requirement or coating designation**>.
c. Topcoat: Varnish, aliphatic polyurethane, two-component[**, MPI #78**].

5. Moisture-Cured Polyurethane System (over Stain): [**MPI RIN 6.5L**]<**Insert system description**>.

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a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Stain, Semi-Transparent, for Interior Wood[, MPI #90].
3) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Stain, Semi-Transparent, for Interior Wood[, MPI #90].

b. Intermediate Coat: [Moisture-cured polyurethane varnish matching topcoat]<Insert requirement or coating designation>.
c. Topcoat: Varnish, polyurethane, moisture cured, gloss (Gloss Level 6)[, MPI #31].
d. Stain Color: Match [adjacent, cleaned wood of same type][existing color][color indicated on Drawings]<Insert color or requirement>.

F. [Plaster]<Insert item description or drawing designation, or both>:

1. Latex System over Waterborne Primer: [MPI RIN 9.2A]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer Sealer, Latex, Interior[, MPI #50].
3) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Stain Blocking, Water Based[, MPI #137].
4) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer Sealer, Latex, Interior[, MPI #50].
5) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Stain Blocking, Water Based[, MPI #137].

b. Intermediate Coat: [Latex matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Latex, interior, flat (Gloss Level 1)[, MPI #53].
2) Latex, interior (Gloss Level 2)[, MPI #44].
3) Latex, interior (Gloss Level 3)[, MPI #52].
4) Latex, interior (Gloss Level 4)[, MPI #43].
5) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].
6) Latex, interior, gloss (Gloss Level 6)[, MPI #114].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

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2. Low-Odor Latex System over Waterborne Primer: [**MPI RIN 9.2M**]<**Insert system description**> system[**over a transition coat**].

    a. Prime Coat:

        1) For [**MPI DSD 1**]<**Insert designation**> degree of surface degradation, touch up with topcoat.
        2) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation, spot prime with Primer Sealer, Latex, Interior[**, MPI #50**].
        3) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation, spot prime with Primer, Stain Blocking, Water Based[**, MPI #137**].
        4) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with Primer Sealer, Latex, Interior[**, MPI #50**].
        5) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat with Primer, Stain Blocking, Water Based[**, MPI #137**].

    b. Topcoat:

        1) Latex, interior, institutional low odor/VOC flat (Gloss Level 1)[**, MPI #143**].
        2) Latex, interior, institutional low odor/VOC (Gloss Level 2)[**, MPI #144**].
        3) Latex, interior, institutional low odor/VOC (Gloss Level 3)[**, MPI #145**].
        4) Latex, interior, institutional low odor/VOC (Gloss Level 4)[**, MPI #146**].
        5) Latex, interior, institutional low odor/VOC, semigloss (Gloss Level 5)[**, MPI #147**].
        6) Latex, interior, institutional low odor/VOC, gloss (Gloss Level 6)[**, MPI #148**].

    c. Color: Match [**Munsell Color 10 G 8/2**][**Plochere Color System #8da399**][**existing colors**][**colors indicated on Drawings**]<**Insert color(s) or requirement**>.

3. Latex System over Alkyd Primer: [**MPI RIN 9.2K**]<**Insert system description**> system[**over a transition coat**].

    a. Prime Coat:

        1) For [**MPI DSD 1**]<**Insert designation**> degree of surface degradation, touch up with topcoat.
        2) For [**MPI DSD 2**]<**Insert designation**> degree of surface degradation, spot prime with Primer Sealer, Alkyd, Interior[**, MPI #45**].
        3) For [**MPI DSD 3**]<**Insert designation**> degree of surface degradation, fully prime coat Primer Sealer, Alkyd, Interior[**, MPI #45**].

    b. Intermediate Coat: [**Latex matching topcoat**]<**Insert requirement or coating designation**>.
    c. Topcoat:

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1) Latex, interior, flat (Gloss Level 1)[, MPI #53].
2) Latex, interior (Gloss Level 2)[, MPI #44].
3) Latex, interior (Gloss Level 3)[, MPI #52].
4) Latex, interior (Gloss Level 4)[, MPI #43].
5) Latex, interior, semigloss (Gloss Level 5)[, MPI #54].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

4. Alkyd System: [MPI RIN 9.2C]<Insert system description> system[over a transition coat].

a. Prime Coat:

1) For [MPI DSD 1]<Insert designation> degree of surface degradation, touch up with topcoat.
2) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer Sealer, Latex, Interior[, MPI #50].
3) For [MPI DSD 2]<Insert designation> degree of surface degradation, spot prime with Primer, Stain Blocking, Water Based[, MPI #137].
4) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer Sealer, Latex, Interior[, MPI #50].
5) For [MPI DSD 3]<Insert designation> degree of surface degradation, fully prime coat with Primer, Stain Blocking, Water Based[, MPI #137].

b. Intermediate Coat: [Alkyd, matching topcoat]<Insert requirement or coating designation>.
c. Topcoat:

1) Alkyd, interior, flat (Gloss Level 1)[, MPI #49].
2) Alkyd, interior (Gloss Level 3)[, MPI #51].
3) Alkyd, interior, semigloss (Gloss Level 5)[, MPI #47].
4) Alkyd, interior, gloss (Gloss Level 6)[, MPI #48].

d. Color: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][existing colors][colors indicated on Drawings]<Insert color(s) or requirement>.

END OF SECTION 090190.52

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstructural steel framing.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior loadbearing, structural framing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of nonstructural steel framing and fastening and anchorage details.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, and attachments to adjoining work.
3. <**Insert requirements**>.

C. Sustainable Design Submittals:

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For code-compliance certification of studs and track.

B. Evaluation Reports: From [**an agency acceptable to authorities having jurisdiction**][**ICC-ES**]<**Insert evaluation agency**> showing compliance with Project requirements, for the following:

1. Studs and track.
2. High-strength steel studs and track.
3. Equivalent corrosion-resistant coating on steel framing.
4. Firestop track.

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5. Post-installed anchors.
6. Power-actuated fasteners.
7. <**Insert requirements**>.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Track: Provide documentation that framing members are certified in accordance with product-certification program of [**the Steel Framing Industry Association**][**the Steel Stud Manufacturers Association**][**or**][**the Supreme Steel Framing System Association**].

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Where indicated on Drawings, provide assemblies incorporating nonstructural steel framing identical to those of assemblies tested for fire resistance in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: Where indicated on Drawings, provide assemblies incorporating nonstructural framing identical to those of assemblies tested in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For [**composite**][**non-composite**] wall assemblies, limited to [**1/240**][**1/360**]<**Insert requirements**> of the wall height based on the following horizontal loading:

1. Horizontal Loading: [**As indicated on Drawings**][**5 lbf/sq. ft.**][**10 lbf/sq. ft.**]<**Insert value**>.

2.2 NONSTRUCTURAL STEEL FRAMING

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with requirements in AISI S220 for conditions indicated on Drawings.

1. Protective Coating: [**ASTM A653/A653M, G40**][**ASTM A653/A653M, G60**]<**Insert requirements**> or coating with demonstrated equivalent corrosion resistance. Galvannealed products are unacceptable.

a. Equivalent Corrosion-Resistant Coating: Evaluation report acceptable to authorities having jurisdiction demonstrates corrosion resistance equivalent to specified protective coating.

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C. Studs and Track: Conventional members, roll-formed into standard shapes without surface deformations to stiffen framing members.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**CEMCO; California Expanded Metal Products Co.**]
b. [**ClarkDietrich**]
c. [**CRACO Mfg., Inc.**]
d. [**Jaimes Industries, Inc.**]
e. [**Marino\WARE**]
f. [**MBA Building Supplies**]
g. [**MBA Metal Framing**]
h. [**MRI Steel Framing, LLC**]
i. [**SCAFCO Steel Stud Company; Stone Group of Companies**]
j. [**Steel Construction Systems; Stone Group of Companies**]
k. [**Steel Network, Inc. (The)**]
l. [**TELLING Industries**]
m. [**UMS Metal Building Systems USA LLC**]
n. [**US Frame Factory**]
o. <**Insert manufacturer's name**>

2. Minimum Base-Steel Thickness: [**As indicated on Drawings**][**As required by performance requirements for horizontal deflection**][0.0179 inch][0.0296 inch].
3. Minimum Yield Strength: 33 ksi.
4. Depth: [**As indicated on Drawings**][1-5/8 inches][2-1/2 inches][3-5/8 inches][4 inches][6 inches]<**Insert dimension**>.

D. Slip-Type Head Joints: Where indicated on Drawings, provide[**one of**] the following:

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Adjustable Wall-Furring Brackets: ASTM A653/A653M [G40][G60] hot-dip galvanized steel sheet in minimum 0.0329-inch- base-steel thickness with serrated edges for attaching furring channels to exterior masonry or concrete walls.

C. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.

1. Adjustable Wall-Furring Brackets for Tie Wire: Use minimum double strand of 0.0625-inch- diameter wire, or triple strand of 0.0475-inch- diameter wire to attach furring channels.
2. Suspended-Ceiling Systems:

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a. Splicing Carrying Channels and Furring Members: Use double loops of minimum 0.0625-inch- diameter wire.
b. Saddle Tying Main Runners and Cross Furring: Use minimum 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

D. Post-Installed Anchors: Fastener systems with an evaluation report, acceptable to authorities having jurisdiction, based on ICC-ES [AC01][AC193][AC58][or][AC308] as appropriate for the substrate.

1. Securing Hangers:

a. Type: [Torque-controlled, expansion anchor][torque-controlled, adhesive anchor][or][adhesive anchor].
b. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated on Drawings.
c. Stainless Steel Material for Exterior or Interior Locations: Alloy [Group 1][Group 2] stainless steel bolts, ASTM F593, and nuts, ASTM F594.

E. Power-Actuated Anchors: Fastener systems with an evaluation report, acceptable to authorities having jurisdiction, based on ICC-ES AC70.

F. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, [0.162 inch]<Insert dimension> in diameter.

G. Flat Hangers: ASTM A653/A653M [G40][G60] hot-dip galvanized steel sheet, [in size indicated on Drawings][1 by 3/16 inch by length indicated on Drawings]<Insert dimensions>.

H. Isolation Strip at Exterior Walls: Provide[one of] the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION OF NONSTRUCTURAL METAL FRAMING, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.

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4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with framing members. Frame both sides of joints independently.

3.2 INSTALLATION OF NONSTRUCTURAL STEEL FRAMING

A. Install framing system components at spacings indicated on Drawings, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: [**As required by horizontal deflection performance requirements**][16 inches **o.c.**][24 inches **o.c.**] unless otherwise indicated on Drawings.
2. Multilayer Application: [**As required by horizontal deflection performance requirements**][16 inches **o.c.**][24 inches **o.c.**] unless otherwise indicated on Drawings.
3. Tile Backing Panels: [**As required by horizontal deflection performance requirements**][16 inches **o.c.**] unless otherwise indicated on Drawings.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install track at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated on Drawings to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated on Drawings.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure unless otherwise indicated on Drawings.

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3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated on Drawings. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated on Drawings and support closures to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Install to maintain continuity of fire-resistance-rated assembly indicated on Drawings.

5. STC-Rated Partitions: Install framing to comply with STC-rated assembly indicated on Drawings.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of at least two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Wall-Furring Bracket Systems: Install brackets with serrated edges facing upward spaced at minimum 48 inches o.c. vertically with 6 inches maximum from floor and ceiling, and minimum 36 inches o.c. horizontally with 4 inches maximum from abutting construction, unless otherwise indicated on Drawings.

G. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced [24 inches]<**Insert dimension**> o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

H. Suspended Assemblies: Isolate suspension assemblies from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

1. Hangers: Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system spaced [**as indicated on Drawings**]<**Insert requirements**>.

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a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

1) Size supplemental suspension members and hangers to support ceiling loads within [**performance limits established by referenced installation standards**]<**Insert deflection limit**>.

c. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
d. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
e. Do not attach hangers to steel roof deck.
f. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
g. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
h. Do not connect or suspend framing from ducts, pipes, or conduit.

2. Carrying Channels (Main Runners): U-channels spaced [**as indicated on Drawings**]<**Insert requirements**>.
3. Furring Channels (Furring Members): [**As indicated on Drawings**][**U-channels**][**Steel studs and track**][**High-strength steel studs and track**][**Rigid hat-shaped furring channels**][**Resilient furring channels**]<**Insert requirements**>.

a. Spacing: [**As indicated on Drawings**]<**Insert requirements**>.
b. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

4. Seismic Bracing: Sway-brace suspension systems [**with hangers used for support**]<**Insert requirements**>.

I. Installation Tolerances for Nonstructural Steel Framing:

1. Framing Members: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.
2. Suspended Assemblies: Install suspension systems that are level to within [1/8 inch in 12 ft.]<**Insert dimensions**> measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 079219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
3. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for steel shaft wall framing, gypsum shaft liners, and other components of shaft wall assemblies.
4. Section 092216 "Non-Structural Metal Framing" for nonstructural steel framing and suspension systems that support gypsum board panels.
5. Section 092613 "Gypsum Veneer Plastering" for gypsum base for veneer plaster and for other components of gypsum-veneer-plaster finishes.
6. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Locations and installation of control and expansion joints, including plans, elevations, sections, and attachment details.

C. Samples for Initial Selection:

1. Trim Accessories: For [**aluminum**][**and**][**base-of-wall PVC moisture-barrier**]<**Insert requirements**> trim.
2. Texture Finish: For each type required.

D. Samples for Verification: Actual sample of finished products for the following:

1. Trim Accessories: Actual sample of finished products for each profile of [**aluminum**][**and**][**base-of-wall PVC moisture-barrier**]<**Insert requirements**> trim required.

    a. Size: Full size profile, [12 inches]<**Insert dimension**> long,

2. Textured Finishes: [**Manufacturer's standard size**]<**Insert requirements**> for each textured finish required and on same backing indicated for Work.

E. Sustainable Design Submittals:

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1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
2. Laboratory Test Reports: For ceiling and wall materials, indicating compliance with requirements for low-emitting materials.

1.3 MOCKUPS

A. Build mockups of at least [100 sq. ft.]<Insert dimension> in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

a. Each level of gypsum board finish required for use in exposed locations.
b. Each texture finish required.

2. Apply or install final decoration required, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings in accordance with ASTM E119; tested by a qualified testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction

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identical to those tested in assembly indicated on Drawings in accordance with ASTM E90 and classified in accordance with ASTM E413; tested by a qualified testing agency.

C. Verify ceiling and wall materials comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert number**> percent.

B. Regional Materials: Verify materials were manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

C. Size: Provide panel products in maximum lengths and widths available that will minimize joints in each area and that correspond with support system specified or indicated on Drawings.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M requirements.

1. Mold-Resistant Joint Compound: Use mold-resistant formulations with mold-resistant panel products.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended in writing by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints[**, rounded or beveled panel edges,**] and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use [**setting-type taping**][**drying-type, all-purpose**] compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

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3. Fill Coat: For second coat, use [**setting-type, sandable topping**][**drying-type, all-purpose**] compound.
4. Finish Coat: For third coat, use [**setting-type, sandable topping**][**drying-type, all-purpose**] compound.
5. Skim Coat: For final coat of Level 5 finish, use [**setting-type, sandable topping compound**][**drying-type, all-purpose compound**][**high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish**].

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended in writing by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended in writing by backing panel manufacturer.
2. Cementitious Backer Units: As recommended in writing by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.4 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended in writing by manufacturer for directly adhering gypsum panels to continuous substrate.

1. Verify adhesives have a VOC content of [**50**]<**Insert number**> g/L or less.

C. Steel Drill Screws: ASTM C1002 unless otherwise specified or indicated on Drawings.

1. Use screws complying with ASTM C954 for fastening panels to steel members from **0.033 to 0.112 inch** thick.
2. For fastening cementitious backer units, use screws of type and size recommended in writing by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers as follows:

1. Non-Fire-Resistance-Rated Assemblies: [**Glass**][**or**][**slag or rock wool**].
2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert number**> percent.

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E. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840 requirements.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

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I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 requirements and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound-attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.2 APPLICATION OF JOINT TREATMENT MATERIALS

A. Finishing Panel Products: Treat joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare panel surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints[, rounded or beveled edges,] and damaged surface areas.

C. Apply joint tape over panel joints, except for trim products specifically indicated as not intended to receive tape.

D. Interior Gypsum Board: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: [Panels that are substrate for tile][Panels that are substrate for acoustical tile][Where indicated on Drawings]<Insert locations>.
3. Level 3: [Where indicated on Drawings]<Insert locations>.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

4. Level 4: [At panel surfaces that will be exposed to view unless otherwise indicated]<Insert locations>.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

5. Level 5: [Where indicated on Drawings]<Insert locations>.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Exterior Gypsum Board for Ceilings and Soffits: Finish in accordance with

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manufacturer's written instructions.

F. Glass-Mat Faced Panels: Finish in accordance with manufacturer's written instructions.

G. Cementitious Backer Units: Finish in accordance with manufacturer's written instructions.

END OF SECTION 092900

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SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thresholds.
2. Setting material.
3. Grout materials.

B. Related Requirements:

1. [**Section 071326 "Self-Adhering Sheet Waterproofing"**][**Section 071353 "Elastomeric Sheet Waterproofing"**][**Section 071354 "Thermoplastic Sheet Waterproofing"**][**Section 071413 "Hot Fluid-Applied Rubberized Asphalt Waterproofing"**][**Section 071416 "Cold Fluid-Applied Waterproofing"**] for waterproofing under thickset mortar beds.
2. Section 079200 "Joint Sealants" for sealing of movement joints in tile surfaces.
3. Section 092400 "Cement Plastering" for scratch coat for thickset mortar setting-bed installations.
4. Section 092613 "Gypsum Veneer Plastering" for cementitious backer units.
5. Section 092900 "Gypsum Board" for tile backing panels.
6. Section 093023 "Glass Tiling."
7. Section 093033 "Stone Tiling."
8. Section 096340 "Stone Flooring" for stone thresholds.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces. [**Show thresholds.**]

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.

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D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.[**For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.**][**For tile with aesthetic classification V3 or V4, provide 12 tiles from same production run.**]
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least [12 inches **square**][36 inches **square**]<**Insert size**>, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory[**for each color and finish required**].
4. Stone thresholds in 6-inch lengths.
5. Metal flooring transitions 6-inch lengths.

E. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.
2. Health Product Declaration: For each product.
3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
4. Environmental Product Declaration: For each product.
5. Environmental Product Declaration: For each product.
6. Environmental Product Declaration: For each product.
7. Third-Party Certifications: For each product.
8. Third-Party Certified Life Cycle Assessment: For each product.
9. Product Data: For adhesives, indicating VOC content.
10. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
11. Laboratory Test Reports: For sealers, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product, including product use classification.

D. Product Test Reports:

1. Tile-setting and -grouting products.
2. Certified porcelain tile.
3. Slip-resistance test reports from qualified independent testing agency.

E. Field Quality-Control Reports: Water test reports of membrane in wet areas.

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1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is [a Five-Star member of the National Tile Contractors Association][or][a Trowel of Excellence member of the Tile Contractors' Association of America].
2. Installer's supervisor for Project holds the International Masonry Institute's Supervisor Certification.
3. Installer employs only [Ceramic Tile Education Foundation Certified Installers][or][installers recognized by the U.S. Department of Labor as Journeyman Tile Layers] for Project.
4. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of [mud floors][mud walls][membranes][shower receptors][and][large format tile].

1.6 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of[each type of] floor tile installation.
2. Build mockup of[each type of] wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.8 WARRANTY

A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.

1. Warranty Period: [Five years][10 years][25 years][Lifetime] from date of Product Purchase.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

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1. Provide tile complying with Standard Grade requirements[**unless otherwise indicated**].

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation [**in swimming pools**][**on exteriors**][**or**][**in wet areas**], do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Installer's option of material that complies with ANSI A108.02, paragraph 3.8.
2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, **2 by 2 inches** by **0.062-inch** diameter; comply with ASTM A1064/A1064M except for minimum wire size.
3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C847.

    a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
    b. Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
    c. Configuration over Studs and Furring: Flat.
    d. Configuration over Solid Surfaces: Self-furring.
    e. Weight: [**2.5 lb/sq. yd.**][**3.4 lb/sq. yd.**].

4. Latex Additive: [**Manufacturer's standard**][**acrylic resin**][**or**][**styrene-butadiene-rubber**] water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.

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1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

    a. [**ARDEX Americas**]
    b. [**Boiardi Products Corporation; a QEP company**]
    c. [**Bostik; Arkema**]
    d. [**C-Cure**]
    e. [**Custom Building Products**]
    f. [**H.B. Fuller Construction Products Inc. / TEC**]
    g. [**Laticrete International, Inc.**]
    h. [**MAPEI Corporation**]
    i. [**Parex, a Sika brand**]
    j. [**Siena Tile & Stone Installation Products; Omega Products International**]
    k. [**Southern Grouts & Mortars, Inc**]
    l. [**Summitville Tiles, Inc.**]
    m. <**Insert manufacturer's name**>

2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.1.

C. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

    a. [**ARDEX Americas**]
    b. [**Atlas Minerals & Chemicals, Inc**]
    c. [**Bostik; Arkema**]
    d. [**C-Cure**]
    e. [**Custom Building Products**]
    f. [**Laticrete International, Inc.**]
    g. [**MAPEI Corporation**]
    h. [**Parex, a Sika brand**]
    i. [**Southern Grouts & Mortars, Inc**]
    j. [**Summitville Tiles, Inc.**]
    k. <**Insert manufacturer's name**>

2. Adhesives shall have a VOC content of [**65**]<**Insert value**> g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu.

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m or 7 ppb, whichever is less.

5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.
6. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.3 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**ARDEX Americas**]
b. [**Boiardi Products Corporation; a QEP company**]
c. [**Bostik; Arkema**]
d. [**C-Cure**]
e. [**Custom Building Products**]
f. [**H.B. Fuller Construction Products Inc. / TEC**]
g. [**Laticrete International, Inc.**]
h. [**MAPEI Corporation**]
i. [**Parex, a Sika brand**]
j. [**Sakrete; CRH Americas, Oldcastle APG**]
k. [**Siena Tile & Stone Installation Products; Omega Products International**]
l. [**Sika Corporation**]
m. [**Southern Grouts & Mortars, Inc**]
n. [**Summitville Tiles, Inc.**]
o. <**Insert manufacturer's name**>

C. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.4 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.

B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.

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C. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Blanke Corporation**]
b. [**Dural USA, Inc.**]
c. [**Profilitec Corp.**]
d. [**Progress Profiles America Inc.**]
e. [**Schluter Systems L.P.**]
f. <**Insert manufacturer's name**>

2. Description: [**L-shaped**][**Square**]<**Insert profile**>.
3. Material and Finish: Metallic or combination of metal and PVC or neoprene base; [**chrome-plated brass**][**polished chrome anodized aluminum**][**polished nickel anodized aluminum**][**color-coated aluminum**][**half-hard brass**][**white zinc alloy**]<**Insert finish**> exposed-edge material.

a. Color: [**Brown**][**White**][**Gray**]<**Insert color**>.

D. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.

E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

F. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's

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written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

D. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

1. Add materials, water, and additives in accurate proportions.
2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Exterior tile floors and walls.
    b. Tile floors in wet areas.
    c. Tile swimming pool decks.
    d. Tile floors in laundries.
    e. Tile floors consisting of tiles 8 by 8 inches or larger.
    f. Tile floors consisting of rib-backed tiles.

2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
4. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

    a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in

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finished Work.

b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

G. Thresholds: Install stone and solid surface thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in [**modified dry-set**][**improved modified dry-set**] mortar (thinset).
2. Do not extend [**cleavage membrane**][**waterproof membrane**][**or**][**crack isolation membrane**] under thresholds set in [**standard dry-set**][**modified dry-set**][**or**][**improved modified dry-set**] mortar. Fill joints between such thresholds and adjoining tile set on [**cleavage membrane**][**waterproof membrane**][**or**][**crack isolation membrane**] with elastomeric sealant.

H. Metal Flooring Transitions: Install [**at locations indicated**][**where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile**][**where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated**].

I. Metal Wall Trim: Install at locations indicated on Drawings.

J. Grout Sealer: Apply grout sealer to[**cementitious**] grout joints[**in tile floors**] in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.2 FIELD QUALITY CONTROL

A. Water Test:

1. Test of waterproofing membrane in showers and similar areas to be performed by Installation Contractor before setting tile.

a. Perform test after 24 hours of waterproof membrane installation.

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b. Insert test plug in drain or waste line.
c. Fill shower base with water, high enough that the membrane-to-drain connection and floor-to-wall transition can be evaluated, and mark wall.
d. Check for leaks after 24 hours.

2. Test to be witnessed by [**Architect**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

B. Nonconforming Work:

1. Waterproof membrane will be considered defective if water level has dropped.
2. Remove and replace defective components and retest.

3.3 EXTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Exterior Floor Installations:

1. TCNA F101 <**Insert designation**>: Method [**ANSI A108.1A**][**ANSI A108.1B**][**ANSI A108.1C**]. Cement mortar bed (thickset) [**bonded to concrete**][**over waterproof membrane on concrete**][**over waterproof membrane on concrete where indicated and bonded to concrete where membrane is not indicated**].

a. Ceramic Tile Type: <**Insert tile-type designation**>.
b. Bond Coat for Cured-Bed Method: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**] grout.
d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid applied**][**Fabric reinforced, fluid applied**].
e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
f. Movement Joints: Types located on Drawings.

2. TCNA F102 <**Insert designation**>: Thinset mortar [**on concrete**][**over waterproof membrane on concrete**][**over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated**][**over crack isolation membrane on concrete**][**over crack isolation membrane on concrete where indicated and on concrete where membrane is not indicated**].

a. Ceramic Tile Type: <**Insert tile-type designation**>.
b. Thinset Mortar: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: [**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**] grout.
d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
e. Crack Isolation Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Asphaltic sheet**][**Fluid-applied**

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membrane][Fabric-reinforced, fluid-applied membrane].
f. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<Insert width>.
g. Movement Joints: Types located on Drawings.

B. Exterior Roof/Deck Floor Installations:

1. TCNA F103 <Insert designation>: Method [ANSI A108.1A][ANSI A108.1B][ANSI A108.1C]. Cement mortar bed (thickset) [over waterproof membrane on concrete][over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated] over drainage material on roof membrane.

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Bond Coat for Cured-Bed Method: [Modified dry-set][Improved modified dry-set] mortar.
c. Grout: [Sand-portland cement][Standard sanded cement][Standard unsanded cement][High-performance sanded cement][High-performance unsanded cement] grout.
d. Waterproof Membrane: [As recommended by setting material manufacturer][Polyethylene sheet][Fluid-applied membrane][Fabric-reinforced, fluid-applied membrane].
e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<Insert width>.
f. Movement Joints: Types located on Drawings.

2. TCNA F104 <Insert designation>: Thinset mortar [on concrete][over waterproof membrane on concrete][over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated][over crack isolation membrane on concrete][over crack isolation membrane on concrete where indicated and on concrete where membrane is not indicated].

a. Ceramic Tile Type: <Insert tile-type designation>.
b. Thinset Mortar: [Modified dry-set][Improved modified dry-set] mortar.
c. Grout: [Standard sanded cement][Standard unsanded cement][High-performance sanded cement][High-performance unsanded cement] grout.
d. Waterproof Membrane: [As recommended by setting material manufacturer][Polyethylene sheet][Fluid-applied membrane][Fabric-reinforced, fluid-applied membrane].
e. Crack Isolation Membrane: [As recommended by setting material manufacturer][Polyethylene sheet][Asphaltic sheet][Fluid-applied membrane][Fabric-reinforced, fluid-applied membrane].
f. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<Insert width>.
g. Movement Joints: Types located on Drawings.

C. Exterior Wall Installations, Masonry or Concrete:

1. TCNA W201 <Insert designation>: Method [ANSI A108.1A][ANSI A108.1B][ANSI A108.1C]. Cement mortar bed (thickset) installed on metal lath [over waterproof membrane][over water-resistant barrier][over vapor-retarder membrane].

a. Ceramic Tile Type: <Insert tile-type designation>.

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b. Bond Coat for Cured-Bed Method: [**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**] grout.
d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
e. Water-Resistive Barrier: Compliant with local code requirements [**and**][**specified in Division 07**].
f. Vapor Retarder: Compliant with local code requirements [**and**][**specified in Division 07**].
g. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
h. Movement Joints: Types located on Drawings.

2. TCNA W202E <**Insert designation**>: Thinset mortar[**over waterproof membrane**][**over water-resistive barrier**][**over vapor retarder membrane**].

a. Ceramic Tile Type: <**Insert tile-type designation**>.
b. Thinset Mortar: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: [**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**] grout.
d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
e. Water-Resistive Barrier: Compliant with local code requirements [**and**][**specified in Division 07**].
f. Vapor Retarder: Compliant with local code requirements [**and**][**specified in Division 07**].
g. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
h. Movement Joints: Types located on Drawings.

D. Exterior Wall Installations, Wood or Metal Studs:

1. TCNA W244E <**Insert designation**>: Thinset mortar [**over waterproof membrane on cementitious backer units**][**on cementitious backer units over vapor-retarder membrane**][**on cementitious backer units over water-resistive barrier**].

a. Ceramic Tile Type: <**Insert tile-type designation**>.
b. Thinset Mortar: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: [**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**] grout.
d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
e. Water-Resistive Barrier: Compliant with local code requirements [**and**][**specified in Division 07**].
f. Vapor Retarder: Compliant with local code requirements [**and**][**specified in**

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Division 07].

g. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
h. Movement Joints: Types located on Drawings.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F111 <**Insert designation**>: Method [**ANSI A108.1A**][**ANSI A108.1B**][**ANSI A108.1C**]. Cement mortar bed (thickset) installed over cleavage membrane.

   a. Ceramic Tile Type: <**Insert tile-type designation**>.
   b. Bond Coat for Cured-Bed Method: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
   c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**] grout.
   d. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
   e. Movement Joints: Types located on Drawings.

2. TCNA F125-Full <**Insert designation**>: Thinset mortar on crack isolation membrane.

   a. Ceramic Tile Type: <**Insert tile-type designation**>.
   b. Thinset Mortar: [**Modified dry-set**][**Improved modified dry-set**] mortar.
   c. Grout: [**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
   d. Crack Isolation Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Asphaltic sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
   e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
   f. Movement Joints: Types located on Drawings.

B. Interior Floor Installations, Wood Subfloor:

1. TCNA F141 <**Insert designation**>: Method [**ANSI A108.1A**][**ANSI A108.1B**][**ANSI A108.1C**]. Cement mortar bed (thickset) installed over cleavage membrane[**over waterproof membrane**].

   a. Ceramic Tile Type: <**Insert tile-type designation**>.
   b. Bond Coat for Cured-Bed Method: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
   c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
   d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
   e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.

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f. Movement Joints: Types located on Drawings.

2. TCNA F142 <**Insert designation**>: Organic adhesive on plywood underlayment.

a. Ceramic Tile Type: <**Insert tile-type designation**>.
b. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded**][**High-performance unsanded**][**Water-cleanable epoxy**] grout.
c. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
d. Movement Joints: Types located on Drawings.

C. Interior Radiant Heat Floor Installations, Concrete Subfloor:

1. TCNA RH110 <**Insert designation**>: Thinset mortar [**on crack isolation membrane**]; hydronic piping installed in concrete.

a. Ceramic Tile Type: <**Insert tile-type designation**>.
b. Thinset Mortar: [**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
d. Crack Isolation Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Asphaltic sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
f. Movement Joints: Types located on Drawings.

2. TCNA RH115 <**Insert designation**>: Thinset mortar; electric radiant system encapsulated in thinset mortar.

a. Ceramic Tile Type: <**Insert tile-type designation**>.
b. Thinset Mortar: [**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: [**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
d. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
e. Movement Joints: Types located on Drawings.

D. Interior Radiant Heat Floor Installations, Wood Subfloor:

1. TCNA RH130 <**Insert designation**>: Thinset mortar on exterior-glue plywood; electric radiant system encapsulated in thinset mortar.

a. Ceramic Tile Type: <**Insert tile-type designation**>.
b. Thinset Mortar: [**EGP (exterior glue plywood) latex-portland cement**][**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: [**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
d. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
e. Movement Joints: Types located on Drawings.

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2. TCNA RH141 <**Insert designation**>: Method [**ANSI A108.1A**][**ANSI A108.1B**][**ANSI A108.1C**]. Cement mortar bed (thickset) installed over cleavage membrane [**and waterproof membrane**]with hydronic piping installed in mortar bed.

    a. Ceramic Tile Type: <**Insert stone tile-type designation**>.
    b. Bond Coat for Cured-Bed Method: [**Modified dry-set**][**Improved modified dry-set**] mortar.
    c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
    d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
    e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
    f. Movement Joints: Types located on Drawings.

E. Interior Wall Installations, Masonry or Concrete:

1. TCNA W202I <**Insert designation**>: Thinset mortar[**over waterproof membrane**].

    a. Ceramic Tile Type: <**Insert tile-type designation**>.
    b. Thinset Mortar: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**][**Water-cleanable epoxy**] mortar.
    c. Grout: [**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
    d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
    e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
    f. Movement Joints: Types located on Drawings.

2. TCNA W211 <**Insert designation**>: Method [**ANSI A108.1A**][**ANSI A108.1B**][**ANSI A108.1C**]. Cement mortar bed (thickset) bonded to substrate[**over waterproof membrane**].

    a. Ceramic Tile Type: <**Insert tile-type designation**>.
    b. Bond Coat for Cured-Bed Method: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
    c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
    d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
    e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
    f. Movement Joints: Types located on Drawings.

F. Interior Wall Installations, Wood or Metal Studs or Furring:

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1. TCNA W242 <**Insert designation**>: Organic adhesive on gypsum board.

    a. Ceramic Tile Type: <**Insert tile-type designation**>.
    b. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
    c. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
    d. Movement Joints: Types located on Drawings.

2. TCNA W245 <**Insert designation**>: Thinset mortar on glass-mat, water-resistant gypsum backer board[**over waterproof membrane**].

    a. Ceramic Tile Type: <**Insert tile-type designation**>.
    b. Thinset Mortar: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
    c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
    d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
    e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
    f. Movement Joints: Types located on Drawings.

G. Bathtub Wall Installations with No Shower Head, Wood or Metal Studs or Furring:

1. TCNA B413 <**Insert designation**>: [**Thinset mortar**][**Organic adhesive**] on [**water-resistant gypsum**][**coated glass-mat, water-resistant gypsum**] backer board.

    a. Ceramic Tile Type: <**Insert tile-type designation**>.
    b. Thinset Mortar: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
    c. Grout: [**Sand-portland cement**][**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
    d. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
    e. Movement Joints: Types located on Drawings.

H. Bathtub/Shower Wall Installations:

1. TCNA B419 <**Insert designation**>: Thinset mortar[**over waterproof membrane**] on coated glass-mat, water-resistant gypsum backer board.

    a. Ceramic Tile Type: <**Insert tile-type designation**>.
    b. Thinset Mortar: [**Modified dry-set**][**Improved modified dry-set**] mortar.
    c. Grout: [**Standard sanded cement**][**Standard unsanded cement**][**High-performance sanded cement**][**High-performance unsanded cement**][**Water-cleanable epoxy**] grout.
    d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].

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e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
f. Movement Joints: Types located on Drawings.

3.5 CHEMICAL-RESISTANT TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete:

1. TCNA F115 <**Insert designation**>: Thinset mortar[**over crack isolation membrane**].

   a. Chemical-Resistant Tile Type: <**Insert tile-type designation**>.
   b. Thinset Mortar: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
   c. Grout: [**Water-cleanable epoxy**][**Chemical-resistant furan**].
   d. Crack Isolation Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Asphaltic sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
   e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
   f. Movement Joints: Types located on Drawings.

2. TCNA F131 <**Insert designation**>: Water-cleanable, tile-setting epoxy.

   a. Chemical-Resistant Tile Type: <**Insert tile-type designation**>.
   b. Grout: Water-cleanable epoxy.
   c. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
   d. Movement Joints: Types located on Drawings.

B. Interior Wall Installations, Masonry or Concrete:

1. TCNA W211 <**Insert designation**>: Method [**ANSI A108.1A**][**ANSI A108.1B**][**ANSI A108.1C**]. Cement mortar bed (thickset) bonded to substrate[**over waterproof membrane**].

   a. Chemical-Resistant Tile Type: <**Insert tile-type designation**>.
   b. Bond Coat for Cured-Bed Method: [**Dry-set**][**Latex-**] portland cement mortar.
   c. Grout: Water-cleanable epoxy.
   d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
   e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
   f. Movement Joints: Types located on Drawings.

C. Interior Wall Installations, Solid Backing:

1. TCNA W222 <**Insert designation**>: Method [**ANSI A108.1A**][**ANSI A108.1B**][**ANSI A108.1C**]. One-coat cement mortar bed (thickset) installed[**over cleavage membrane**][**over waterproof membrane**] on solid backing.

   a. Chemical-Resistant Tile Type: <**Insert tile-type designation**>.

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b. Bond Coat for Cured-Bed Method: [**Dry-set**][**Modified dry-set**][**Improved modified dry-set**] mortar.
c. Grout: Water-cleanable epoxy.
d. Waterproof Membrane: [**As recommended by setting material manufacturer**][**Polyethylene sheet**][**Fluid-applied membrane**][**Fabric-reinforced, fluid-applied membrane**].
e. Joint Width: [1/8 inch][3/16 inch][1/4 inch][3/8 inch]<**Insert width**>.
f. Movement Joints: Types located on Drawings.

END OF SECTION 093013

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SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl base.
2. Vinyl stair treads.
3. Rubber molding accessories.
4. Vinyl molding accessories.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096516 "Resilient Sheet Flooring" for resilient rolled flooring.
3. Section 096519 "Resilient Tile and Plank Flooring" for modular resilient flooring.
4. Section 096543 "Linoleum Flooring" for modular and sheet linoleum flooring.
5. Section 096813 "Tile Carpeting" for modular carpet tile flooring.
6. Section 096816 "Sheet Carpeting" for tufted and woven carpet flooring.
7. Section 104513 "Photoluminescent Egress Path Markings" for luminous stair accessories.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference [**at Project site**][**by web conference**]<**Insert location**>.

1. Review methods and procedures related to resilient base and accessory installation including, but not limited to, the following:

a. Delivery, storage, and handling procedures.
b. Ambient conditions and ventilation procedures.
c. Subfloor preparation procedures for resilient stair accessories.
d. <**Insert agenda items**>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation instructions for each type of substrate.

B. Samples: For each exposed product and for each color and texture specified, not less

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than 12 inches long.

C. Samples for Initial Selection: For each type of exposed product.

D. Samples for Verification: For each type of exposed product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

E. Product Schedule: For resilient base and accessory products.[**Use same designations indicated on Drawings.**]

F. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.
2. Environmental Product Declaration (EPD): For each product.
3. Third-Party Certifications: For each product.
4. Third-Party-Certified Life-Cycle Assessment: For each product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For resilient base and accessory products, for tests performed by a qualified testing agency.

1.5 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than [70 deg F]<**Insert temperature**> or more than [95 deg F]<**Insert temperature**>, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than [55 deg F]<**Insert temperature**> or more than [95 deg F]<**Insert temperature**>.

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C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical products in accordance with ASTM E648 or ASTM E662 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Verify flooring products comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.

2.2 RESILIENT BASE

A. Vinyl Base:

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

   a. [**Flexco Corporation**]
   b. [**Mannington Mills, Inc**]
   c. [**Mohawk Group**]
   d. [**Roppe Corporation; Roppe Holding Company**]
   e. [**Shaw Industries Group, Inc.; Berkshire Hathaway Company**]
   f. [**Tarkett USA**]
   g. [**VPI Corporation**]
   h. <**Insert manufacturer's name**>

2. Classification: ASTM F1861, Type TV (vinyl, thermoplastic), Group [**I (solid, homogeneous)**][**or**][**II (layered)**].
3. Style and Location:

   a. Style A, Straight: [**Provide in areas with carpet**]<**Insert requirements**>.
   b. Style B, Cove: [**Provide in areas with resilient floor coverings**]<**Insert requirements**>.

4. Minimum Thickness: [0.125 inch][0.080 inch]<**Insert dimension**>.
5. Height: [2-1/2 inches][4 inches][6 inches][**As indicated on Drawings**].
6. Lengths: [**Cut lengths 48 inches long**][**Coils in manufacturer's standard length**][**Cut lengths 48 inches long or coils in manufacturer's standard length**].
7. Outside Corners: [**Job formed**][**Preformed**][**Job formed or preformed**].

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8. Inside Corners: [**Job formed**][**Preformed**][**Job formed or preformed**].
9. Colors and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's sample**]<**Insert colors and patterns**>.

2.3 RESILIENT STAIR ACCESSORIES

A. Vinyl Stair Treads:

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

    a. [**Flexco Corporation**]
    b. [**Roppe Corporation; Roppe Holding Company**]
    c. [**Tarkett USA**]
    d. [**VPI Corporation**]
    e. <**Insert manufacturer's name**>

2. Classification: ASTM F2169, Type TV (vinyl, thermoplastic).

    a. Class: [**1 (smooth, flat)**][**2 (pattern; embossed, grooved, or ribbed)**].
    b. Group: [**1 (embedded abrasive strips)**][**2 (with contrasting color for the visually impaired)**].

3. Nosing Style: [**Square, adjustable to cover angles between 60 and 90 degrees**][**Square**][**Round**].
4. Nosing Height: [1-1/2 inches][2 inches][2-3/16 inches]<**Insert dimension**>.
5. Thickness: [1/4 inch **and tapered to back edge**]<**Insert thickness**>.
6. Size: Lengths and depths to fit each stair tread in [**one piece**][**one piece or, for treads exceeding maximum lengths manufactured, in equal-length units**].

B. Integral Risers: Smooth, flat; in height that fully covers substrate.

C. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer who produced treads and recommended by manufacturer for installation with treads.

1. Style: [**Coved toe,** 7 inches **high by length matching treads**][**Toeless, by length matching treads**].
2. Thickness: [0.125 inch][**Manufacturer's standard**]<**Insert thickness**>.

D. Stringers: Height and length after cutting to fit risers and treads and to cover stair stringers, produced by same manufacturer who produced treads, and recommended by manufacturer for installation with treads.

1. Thickness: [0.125 inch][0.080 inch][**Manufacturer's standard**]<**Insert thickness**>.

E. Landing Tile: [**Matching treads; produced by same manufacturer who produced treads and recommended by manufacturer for installation with treads**]<**Insert requirements**>.

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F. Locations: [**Provide resilient stair accessories in areas indicated**]<**Insert requirements**>.

G. Colors and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's sample**]<**Insert colors and patterns**>.

2.4 RESILIENT MOLDING ACCESSORIES

A. Rubber Molding Accessories :

1. Accessory Description: [**Stair-tread nosing**][**cap for cove carpet**][**cap for cove resilient floor covering**][**carpet bar for tackless installations**][**carpet edge for glue-down applications**][**nosing for carpet**][**nosing for resilient floor covering**][**reducer strip for resilient floor covering**][**joiner for tile and carpet**][**transition strips**]<**Insert description**>.
2. Profile and Dimensions: [**As indicated**]<**Insert profile and dimensions**>.

B. Vinyl Molding Accessories :

1. Accessory Description: [**Stair-tread nosing**][**cap for cove carpet**][**cap for cove resilient floor covering**][**carpet bar for tackless installations**][**carpet edge for glue-down applications**][**nosing for carpet**][**nosing for resilient floor covering**][**reducer strip for resilient floor covering**][**joiner for tile and carpet**][**transition strips**]<**Insert description**>.
2. Profile and Dimensions: [**As indicated**]<**Insert profile and dimensions**>.

C. Locations: [**Provide resilient molding accessories in areas indicated**]<**Insert requirements**>.

D. Colors and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's sample**]<**Insert colors and patterns**>.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended in writing by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

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D. Metal Edge Strips: [**Extruded aluminum with mill finish**]<**Insert requirements**>, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

2.6 Corner Guard Accessories

A. Basis-of-Design Product: Subject to compliance with requirements, provide <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

1. [**Roppe Corporation; Roppe Holding Company**]
2. <**Insert manufacturer's name**>

PART 3 - EXECUTION

3.1 INSTALLATION OF RESILIENT BASE

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than [3 inches]<**Insert dimension**> in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than [3 inches]<**Insert dimension**> in length.

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a. [Miter][Cope][Miter or cope] corners to minimize open joints.

3.2 INSTALLATION OF RESILIENT STAIR ACCESSORIES

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

END OF SECTION 096513

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SECTION 096519 - RESILIENT TILE AND PLANK FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial luxury vinyl floor planks.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with resilient tile and plank flooring.
3. Section 096516 "Resilient Sheet Flooring" for resilient rolled flooring.
4. Section 096543 "Linoleum Flooring" for modular and sheet linoleum flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Review methods and procedures related to resilient tile and plank flooring installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.
d. <**Insert agenda items**>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturers' written data on physical characteristics, durability, and fade resistance.
2. Include manufacturers' written installation instructions for each type of substrate.

B. Shop Drawings: For each type of resilient flooring type required.

1. Include flooring layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples: Full-size units of each color, texture, and pattern of resilient flooring type required.

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D. Samples for Initial Selection: For each type of resilient flooring product required.

E. Samples for Verification: Full-size units of each color and pattern of resilient flooring type required.

F. Product Schedule: For each type of resilient flooring product required.[**Use same designations indicated on Drawings.**]

G. Sustainable Design Submittals:

1. Verify products comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
2. Product Data: For adhesives, indicating VOC content.
3. Environmental Product Declaration (EPD): For each product.
4. Environmental Product Declaration (EPD): For each product.
5. Third-Party Certifications: For each product.
6. Third-Party-Certified Life-Cycle Assessment: For each product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For resilient flooring, for tests performed by a qualified testing agency.

B. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient flooring product type to include:

1. Methods for maintaining resilient flooring, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to resilient flooring.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient flooring manufacturer for installation techniques required.

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1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups [**as indicated on Drawings**]<**Insert mockup requirements**>.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install resilient flooring until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

B. Do not install resilient flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by resilient flooring manufacturer.

C. Adhesively Applied Products:

1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than [70 deg F]<**Insert temperature**> or more than [95 deg F]<**Insert temperature**>, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than [55 deg F]<**Insert temperature**> or more than [95 deg F]<**Insert temperature**>.
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

1.9 WARRANTY

A. Special Warranty for Resilient Flooring Products: Manufacturer agrees to repair or replace components of flooring installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of flooring due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Warranty Period: [**10**]<**Insert number**> years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products in accordance with ASTM E648 or ASTM E662 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Verify flooring products comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.

C. Verify products comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.

D. Verify products comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

1. Verify adhesive has a VOC content of [**50**][**70**]<**Insert number**> g/L or less.

2.2 RESILIENT TILE AND PLANK FLOORING

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert number**> percent.

B. Commercial Luxury Vinyl Floor Planks: Solid, resilient plank flooring product composed of binder, fillers, and pigments compounded with suitable stabilizers and processing aids; marketed as luxury vinyl planks (LVP).

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Altro**]
b. [**American Biltrite**]
c. [**Armstrong Flooring, Inc.**]
d. [**Flexco Corporation**]
e. [**Gerflor USA**]
f. [**Mannington Mills, Inc**]
g. [**Mohawk Group**]
h. [**Roppe Corporation; Roppe Holding Company**]
i. [**Shaw Industries Group, Inc.; Berkshire Hathaway Company**]

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j. [Tarkett USA]
k. [van Gelder, Inc]
l. <Insert manufacturer's name>

2. Classification: ASTM F1700, Class III, Printed Film Vinyl Tile.

a. Type: [A, Smooth Surface][B, Embossed Surface].

3. Overall Thickness: [0.080 inch][0.100 inch][0.120 inch][0.125 inch]<Insert dimension> including manufacturer's standard clear wear layer and UV-cured polyurethane topcoat.
4. Nominal Size: [12 by 12 inches][12 by 24 inches][18 by 18 inches][24 by 24 inches][36 by 36 inches][3 by 36 inches][6 by 48 inches][9 by 60 inches]<Insert dimensions>.
5. Colors and Patterns: [As indicated by manufacturer's designations][Match Architect's samples]<Insert colors and patterns>.
6. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended in writing by floor tile and adhesive manufacturers for substrate and conditions indicated.

1. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

C. Vapor Retarder: ASTM D4397, polyethylene sheet not less than [6.0 mils][8.0 mils] thick.

D. Asphalt-Saturated Felt: ASTM D4869/D4869M, Type II.

E. Seamless-Installation Accessories: Manufacturer's standard product for chemically bonding seams.

F. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

G. Joint Sealant for Resilient Terrazzo Floor Tile: Silicone sealant of type and grade recommended in writing by floor tile manufacturer to suit application.

1. Joint-Sealant Color: [White][As selected by Architect from manufacturer's full range to match floor tile][Match floor tile]<Insert color>.

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a. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

H. Sealers and Finish Coats for Resilient Terrazzo Floor Tile: Products recommended by floor tile manufacturer to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION OF RESILIENT TILE AND PLANK FLOORING

A. Comply with manufacturer's written installation instructions.

B. Discard broken, cracked, chipped, or deformed tiles.

C. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles [**square with room axis**][**at a 45-degree angle with room axis**][**in pattern indicated**]<**Insert requirements**>.

D. Tile Matching: Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered.

1. Lay tiles [**with grain running in one direction**][**with grain direction alternating in adjacent tiles (basket-weave pattern)**][**in pattern of colors and sizes indicated**].

E. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

F. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

H. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

I. Adhered Floor Tile: Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written installation instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times, to produce a completed installation without open

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cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

J. Floating Floor Tile: Install LVT floor tiles in accordance with flooring manufacturer's written installation instructions.

K. Seamless Installation: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

L. Resilient Terrazzo Accessories: Install in accordance with manufacturer's written instructions.

END OF SECTION 096519

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SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation of interior substrates and application of the following:

1. Primers.
2. Water-based finish coatings.
3. Solvent-based finish coatings.
4. Floor sealers and paints.
5. Dry fall coatings.

B. Related Requirements:

1. [**Section 051200 "Structural Steel Framing"**][**Section 051213 "Architecturally Exposed Structural Steel Framing"**] for shop priming structural steel substrates.
2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
4. Section 055116 "Metal Floor Plate Stairs" for shop priming metal floor plate stairs.
5. Section 055119 "Metal Grating Stairs" for shop priming metal grating stairs.
6. Section 055213 "Pipe and Tube Railings" for shop [**priming**][**painting**] pipe and tube railings.
7. [**Section 055313 "Bar Gratings"**][**Section 055316 "Plank Gratings"**][**Section 055319 "Expanded Metal Gratings"**] for shop priming metal gratings.
8. Section 099113 "Exterior Painting."
9. Section 099300 "Staining and Transparent Finishing" for surface preparation and application of wood stains and transparent finishes on interior wood substrates.
10. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples: For each type of topcoat product.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat. Submit [**actual paint drawdowns as specified below**][**paint manufacturer's standard printed cards**] for verification Samples.

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1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in applicable interior painting schedule articles to cross-reference paint systems specified in this Section. Include color designations.

F. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Environmental Product Declaration (EPD): For each product.
3. Environmental Product Declaration (EPD): For each product.
4. Third-Party Certifications: For each product.
5. Third-Party-Certified Life-Cycle Assessment: For each product.

1.3 MOCKUPS

A. Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
   b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

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PART 2 - PRODUCTS

2.1 INTERIOR PAINTS, GENERAL

A. Interior Paints: Subject to compliance with requirements, [**provide product**][**provide one of the products**][**available products that may be incorporated into the Work include but are not limited to products**] listed in product types below and applicable interior painting schedule articles for the paint category indicated.

B. Material Compatibility:

1. Materials for use within each paint system must be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.

C. Material Emissions and Pollutant Control: Verify not less than 85 percent of field-applied paints and coatings that are inside the weatherproofing system comply with either of the following:

1. Low-Emitting Materials: Verify VOC emissions comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
2. Verify VOC content does not exceed limits of authorities having jurisdiction and the following:

a. Flat Coatings: 50 g/L.
b. Nonflat Coatings: 100 g/L.
c. Nonflat - High-Gloss Coatings: 150 g/L.
d. Concrete/Masonry Sealers: 100 g/L.
e. Floor Coatings: 100 g/L.
f. Industrial Maintenance Coatings: 250 g/L.
g. Low-Solids Coatings: 120 g/L.
h. Mastic Texture Coatings: 100 g/L.
i. Metallic Pigmented Coatings: 500 g/L.
j. Pretreatment Wash Primers: 420 g/L.
k. Primers, Sealers, and Undercoaters: 100 g/L.
l. Reactive Penetrating Sealers: 350 g/L.
m. Recycled Coatings: 250 g/L.
n. Rust-Preventive Coatings: 250 g/L.

D. Colors: [**As selected by Architect from manufacturer's full range**][**Match Architect's samples**][**As indicated in a color schedule**]<**Insert requirements**>.

1. [**10**][**20**][**30**]<**Insert number**> percent of surface area will be painted with deep tones.

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2.2 PRIMERS

A. Interior Latex Primer Sealer: Pigmented, water-based latex sealer; formulated to reduce porosity of substrate for finish coats; for use on new interior plaster, concrete, and gypsum board substrates. Not intended for use on wood or previously painted surfaces.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Behr Paint Company (Behr Process LLC)**]
b. [**Hempel (USA), Inc.**]
c. [**McCormick Paints**]
d. [**Rodda Paint Co.**]
e. [**Sherwin-Williams Company (The)**]
f. [**The Pittsburgh Paints Company**]
g. <**Insert manufacturer's name**>

B. Interior, Latex Primer for Wood: Waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbials; for hiding stains; and for use on interior wood substrates.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Behr Paint Company (Behr Process LLC)**]
b. [**Benjamin Moore & Co.**]
c. [**KILZ (Behr Paint Company)**]
d. [**Rodda Paint Co.**]
e. [**Sherwin-Williams Company (The)**]
f. [**The Pittsburgh Paints Company**]
g. [**Valspar; a brand of The Sherwin-Williams Company**]
h. <**Insert manufacturer's name**>

2.3 WATER-BASED FINISH COATINGS

A. Interior Latex Paint: Pigmented, water-based coating for use on interior primed/sealed plaster and gypsum board, and on primed wood and metals.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Behr Paint Company (Behr Process LLC)**]
b. [**Benjamin Moore & Co.**]

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c. [Coronado Paint; Benjamin Moore & Co.]
d. [Insl-X Products; Benjamin Moore & Co.]
e. [McCormick Paints]
f. [Rodda Paint Co.]
g. [Sherwin-Williams Company (The)]
h. [The Pittsburgh Paints Company]
i. [Valspar; a brand of The Sherwin-Williams Company]
j. <Insert manufacturer's name>

2. Gloss and Sheen Level: Manufacturer's standard [flat][low sheen][eggshell][satin][semigloss][gloss].

B. Interior, Latex, Institutional Low-Odor/VOC Paint: White or colored latex coating with low-odor characteristics and a VOC of less than 10 grams per liter, for use in areas, such as hospitals and other occupied buildings, where the odor and VOC levels of conventional latex products would preclude their use.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [Behr Paint Company (Behr Process LLC)]
b. [Benjamin Moore & Co.]
c. [McCormick Paints]
d. [Rodda Paint Co.]
e. [Sherwin-Williams Company (The)]
f. [The Pittsburgh Paints Company]
g. <Insert manufacturer's name>

2. Gloss and Sheen Level: Manufacturer's standard [flat][low sheen][eggshell][satin][semigloss][gloss].

2.4 FLOOR SEALERS AND PAINTS

A. Water-Based Concrete Floor Sealer: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on concrete traffic surfaces.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [Behr Paint Company (Behr Process LLC)]
b. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
c. [Sherwin-Williams Company (The)]
d. [The Pittsburgh Paints Company]
e. <Insert manufacturer's name>

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PART 3 - EXECUTION

3.1 APPLICATION OF INTERIOR PAINT PRODUCTS

A. Apply paints in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in the applicable interior painting schedule articles may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view in equipment rooms:

a. Equipment, including panelboards[and switch gear].
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
i. <Insert mechanical items to be painted>.

2. Paint the following work where exposed to view in occupied spaces:

a. Equipment, including panelboards.

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b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.
i. <**Insert requirements**>.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.2 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.
3. Cost of retesting is Contractor's responsibility.

3.3 INTERIOR PAINTING SCHEDULE, CONCRETE SUBSTRATES

A. Vertical (Nontraffic) Surfaces:

1. Latex System :

a. Prime Coat: [**Alkali-resistant, water-based primer**][**Matching topcoat**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex over Latex Aggregate System :

a. Prime Coat: Textured latex coating, flat.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Latex Aggregate System :

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: Textured latex coating, [**flat**][**nonflat**].

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4. Institutional Low-Odor/VOC Latex System :

    a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

5. High-Performance Architectural Latex System :

    a. Prime Coat: Alkali-resistant, water-based primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

6. Antiviral/Antibacterial Latex System :

    a. Prime Coat: Alkali-resistant, water-based primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

7. Water-Based Light Industrial Coating System :

    a. Prime Coat: Alkali-resistant, water-based primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based, light industrial coating, [**eggshell**][**semigloss**][**gloss**].

8. Alkyd System :

    a. Prime Coat: Alkali-resistant, water-based primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

9. Water-Based Alkyd System :

    a. Prime Coat: Alkali-resistant, water-based primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

10. Concrete Stain System :

    a. First Coat: Matching topcoat.
    b. Topcoat: Interior concrete stain.

B. Horizontal (Traffic) Surfaces:

1. Latex Floor Enamel System :

    a. Prime Coat: Matching topcoat
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Latex floor enamel, [**low gloss**][**gloss**].

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2. Alkyd Floor Enamel System :

   a. Prime Coat: Matching topcoat.
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Alkyd floor enamel, [low gloss][gloss].

3. Concrete Stain System :

   a. First Coat: Matching topcoat.
   b. Topcoat: Interior concrete stain.

4. Solvent-Based Concrete Floor Sealer System :

   a. First Coat: Matching topcoat.
   b. Topcoat: Solvent-based concrete floor sealer.

5. Water-Based Concrete Floor Sealer System :

   a. First Coat: Matching topcoat.
   b. Topcoat: Water-based concrete floor sealer.

6. Latex Zone/Traffic-Marking Paint System :

   a. Traffic-marking paint, latex.

7. Alkyd Zone/Traffic-Marking Paint System :

   a. Traffic-marking paint, solvent based.

3.4 INTERIOR PAINTING SCHEDULE, CEMENTITIOUS SUBSTRATES

A. Cementitious Composition Board Substrates: [Siding][Trim][Panels]<Insert requirements>.

1. Latex System :

   a. Prime Coat: Alkali-resistant, water-based primer.
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Interior latex paint, [flat][low sheen][eggshell][satin][semigloss][gloss].

2. Institutional Low-Odor/VOC Latex System :

   a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Interior, latex, institutional low odor/VOC, [flat][low sheen][eggshell][satin][semigloss][gloss].

3. High-Performance Architectural Latex System :

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a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

4. Water-Based Light Industrial Coating System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based, light industrial coating, [**eggshell**][**semigloss**][**gloss**].

5. Antiviral/Antibacterial Latex System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

6. Alkyd System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

7. Water-Based Alkyd System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

3.5 INTERIOR PAINTING SCHEDULE, MASONRY SUBSTRATES

A. Clay Masonry Substrates:

1. Latex System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex Aggregate System :

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Textured latex coating, [**flat**][**nonflat**].

3. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.

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b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Water-Based Light Industrial Coating System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based, light industrial coating, [**eggshell**][**semigloss**][**gloss**].

6. Antiviral/Antibacterial Latex System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

7. Alkyd System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

8. Water-Based Alkyd System :

a. Prime Coat: Alkali-resistant, water-based primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

B. CMU Substrates:

1. Latex System :

a. Block Filler: Interior/exterior latex block filler.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex Aggregate System :

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Textured latex coating, [**flat**][**nonflat**].

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3. Institutional Low-Odor/VOC Latex System :

    a. Block Filler: Interior/exterior latex block filler.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

    a. [**Block Filler: Interior/exterior latex block filler**][**Prime Coat: Alkali-resistant, water-based primer**].
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Water-Based Light Industrial Coating System :

    a. Block Filler: Interior/exterior latex block filler.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based, light industrial coating, [**eggshell**][**semigloss**][**gloss**].

6. Antiviral/Antibacterial Latex System :

    a. Block Filler: Interior/exterior latex block filler.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

7. Alkyd System :

    a. Block Filler: Interior/exterior latex block filler.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

8. Water-Based Alkyd System :

    a. Block Filler: Interior/exterior latex block filler.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

3.6 INTERIOR PAINTING SCHEDULE, METAL SUBSTRATES

A. Steel and Iron Substrates:

1. Latex System, Alkyd Primer :

    a. Prime Coat: [**Alkyd quick-dry primer for metal**][**Alkyd metal primer**][**Shop primer specified in Section where substrate is specified**].
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior latex paint, [**flat**][**low**

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sheen][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex over Shop-Applied Quick-Drying Shop Primer System :

    a. Prime Coat: Quick-dry primer for shop application.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Institutional Low-Odor/VOC Latex System :

    a. Prime Coat: Water-based rust-inhibitive primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

    a. Prime Coat: [**Alkyd quick-dry primer for metal**][**Alkyd metal primer**][**Shop primer specified in Section where substrate is specified**].
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Water-Based Light Industrial Coating System :

    a. Prime Coat: Primer, rust-inhibitive, water based.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based, light industrial coating, [**eggshell**][**semigloss**][**gloss**].

6. Water-Based Light Industrial Coating System over Epoxy Primer System :

    a. Prime Coat: Epoxy, anticorrosive primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based, light industrial coating, [**eggshell**][**semigloss**][**gloss**].

7. Water-Based Dry-Fall System :

    a. Prime Coat: [**Alkyd quick-dry primer for metal**][**Alkyd metal primer**][**Shop primer specified in Section where substrate is specified**].
    b. Topcoat: [**Dry fall, latex, flat**][**Dry fall, water-based for galvanized steel, flat**][**Dry fall, latex, low sheen**][**Dry fall, latex, semigloss**].

8. Antiviral/Antibacterial Latex System :

    a. Prime Coat: Alkyd quick-dry primer for metal.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

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9. Alkyd System :

    a. Prime Coat: [**Alkyd quick-dry primer for metal**][**Alkyd metal primer**][**Shop primer specified in Section where substrate is specified**].
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

10. Alkyd over Surface-Tolerant Primer System :

    a. Prime Coat: Surface-tolerant metal primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**] .

11. Alkyd over Rust-Inhibitive Primer System :

    a. Prime Coat: Primer, rust inhibitive, water based.
    b. Intermediate Coat: Alkyd, interior, matching topcoat.
    c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

12. Alkyd over Shop-Applied Quick-Drying Shop Primer System :

    a. Prime Coat: Primer, quick dry, for shop application.
    b. Intermediate Coat: Alkyd, interior, matching topcoat.
    c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

13. Water-Based Alkyd System :

    a. Prime Coat: [**Alkyd quick-dry primer for metal**][**Quick-dry primer for shop application**][**Primer, rust inhibitive, water based**][**Surface-tolerant metal primer**].
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

14. Quick-Dry Enamel System :

    a. Prime Coat: Alkyd quick-dry primer for metal.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

15. Alkyd Dry-Fall System :

    a. Prime Coat: [**Alkyd quick-dry primer for metal**][**Alkyd metal primer**][**Shop primer specified in Section where substrate is specified**].
    b. Topcoat: Dry fall, alkyd, [**flat**][**low sheen**][**semigloss**].

16. Alkyd Dry Fall over Quick-Drying Primer System :

    a. Prime Coat: Quick-dry primer for shop application.
    b. Topcoat: Dry fall, alkyd, [**flat**][**low sheen**][**semigloss**].

17. Aluminum Paint System :

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a. Prime Coat: [**Alkyd quick-dry primer for metal**][**Alkyd metal primer**][**Shop primer specified in Section where substrate is specified**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Aluminum paint.

B. Galvanized Metal Substrates:

1. Latex System :

a. Prime Coat: [**Cementitious galvanized primer**][**Water-based galvanized primer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Water-based galvanized primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. High-Performance Architectural Latex System :

a. Prime Coat: Water-based galvanized primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

4. Water-Based Light Industrial Coating System :

a. Prime Coat: Cementitious galvanized primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based, light industrial coating, [**low sheen**][**semigloss**][**gloss**].

5. Antiviral/Antibacterial Latex System :

a. Prime Coat: Water-based galvanized primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

6. Water-Based Dry-Fall System :

a. Prime Coat: Matching topcoat.
b. Topcoat: Dry fall, water-based for galvanized steel, flat.

7. Alkyd System :

a. Prime Coat: Water-based galvanized primer.
b. Intermediate Coat: Matching topcoat.

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c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

8. Water-Based Alkyd System :

a. Prime Coat: Water-based galvanized primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

9. Alkyd Dry-Fall System :

a. Prime Coat: Water-based galvanized primer.
b. Topcoat: Dry fall, alkyd, [**flat**][**low sheen**][**semigloss**].

10. Aluminum Paint System :

a. Prime Coat: Water-based galvanized primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Aluminum paint.

C. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Latex System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. High-Performance Architectural Latex System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

4. Aluminum Paint System :

a. Prime Coat: Vinyl wash primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Aluminum paint.

5. Water-Based Light Industrial Coating System :

a. Prime Coat: Quick-dry primer for aluminum.

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b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based, light industrial coating, [low sheen][semigloss][gloss].

6. Antiviral/Antibacterial Latex System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex, antiviral/antibacterial coating, [eggshell][semigloss].

7. Alkyd System :

a. Prime Coat: Primer, [Vinyl wash primer][Quick-dry primer for aluminum].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [flat][low sheen][semigloss][gloss].

8. Water-Based Alkyd System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [low sheen][semigloss][gloss].

D. Copper Substrates:

1. Latex System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [flat][low sheen][eggshell][satin][semigloss][gloss].

2. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [flat][low sheen][eggshell][satin][semigloss][gloss].

3. High-Performance Architectural Latex System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [low sheen][eggshell][satin][semigloss].

4. Water-Based Light Industrial Coating System :

a. Prime Coat: Quick-dry primer for aluminum.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based, light industrial coating, [low sheen][semigloss][gloss].

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5. Aluminum Paint System :

    a. Prime Coat: Vinyl wash primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Aluminum paint.

6. Antiviral/Antibacterial Latex System :

    a. Prime Coat: Quick-dry primer for aluminum.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

7. Alkyd System :

    a. Prime Coat: Vinyl wash primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

E. Stainless Steel Substrates:

1. Latex System :

    a. Prime Coat: Solvent-based bonding primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. High-Performance Architectural Latex System :

    a. Prime Coat: Solvent-based bonding primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

3. Water-Based Light Industrial Coating System :

    a. Prime Coat: [**Solvent-based bonding primer**][**Quick-dry primer for aluminum**].
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based, light industrial coating, [**low sheen**][**semigloss**][**gloss**].

4. Aluminum Paint System :

    a. Prime Coat: Vinyl wash primer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Aluminum paint.

5. Antiviral/Antibacterial Latex System :

    a. Prime Coat: Quick-dry primer for aluminum.

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b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

6. Alkyd System :

a. Prime Coat: Vinyl wash primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

3.7 INTERIOR PAINTING SCHEDULE, WOOD SUBSTRATES

A. Glued-Laminated Wood Substrates:

1. Latex over Latex Primer System :

a. Prime Coat: Interior, latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex over Alkyd Primer System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Antiviral/Antibacterial Latex System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

6. Alkyd System :

a. Prime Coat: Interior alkyd primer sealer.

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b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

7. Water-Based Alkyd System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

B. Exposed Wood Framed Substrates:

1. Latex over Latex Primer System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex over Alkyd Primer System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Antiviral/Antibacterial Latex System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

6. Alkyd System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

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7. Water-Based Alkyd System :

    a. Prime Coat: Interior alkyd primer sealer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

C. Finish Carpentry Substrates: [**Wood trim**][**Doors**][**Windows**][**and**][**Wood board paneling**].

1. Latex over Latex Primer System :

    a. Prime Coat: Interior latex primer for wood.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex over Alkyd Primer System :

    a. Prime Coat: Interior alkyd primer sealer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Institutional Low-Odor/VOC Latex System :

    a. Prime Coat: Interior latex primer for wood.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

    a. Prime Coat: Interior latex primer for wood.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Water-Based Light Industrial Coating System :

    a. Prime Coat: Interior alkyd primer sealer.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, water-based, light industrial coating, [**low sheen**][**semigloss**][**gloss**].

6. Antiviral/Antibacterial Latex System :

    a. Prime Coat: Interior latex primer for wood.
    b. Intermediate Coat: Matching topcoat.
    c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

7. Alkyd System :

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a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

8. Water-Based Alkyd System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

D. Architectural Woodwork Substrates: [**Wood paneling**][**and**][**Casework**].

1. Latex over Latex Primer System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex over Alkyd Primer System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Water-Based Light Industrial Coating System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based, light industrial coating, [**low sheen**][**semigloss**][**gloss**].

6. Antiviral/Antibacterial Latex System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.

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c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

7. Alkyd System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

8. Water-Based Alkyd System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

E. Wood Traffic Substrates: [**Floors**][**and**][**stairs**].

1. Latex Porch and Floor Enamel System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Latex floor enamel, low gloss.
d. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.

2. Alkyd Floor Enamel System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Alkyd floor enamel, gloss.
d. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.

F. Wood Shingle and Shake Substrates:

1. Latex over Latex Primer System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex over Alkyd Primer System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Antiviral/Antibacterial Latex System :

a. Prime Coat: Interior latex primer for wood.

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b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

4. Alkyd System :

a. Prime Coat: Interior, alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

5. Water-Based Alkyd System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

3.8 INTERIOR PAINTING SCHEDULE, GYPSUM-BASED SUBSTRATES

A. Gypsum Board and Plaster Substrates:

1. Latex over Latex Sealer System :

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Latex over Alkyd Primer System (for Plaster Only) :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Water-Based Light Industrial Coating System :

a. Prime Coat: Interior latex primer sealer.

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b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based, light industrial coating, [low sheen][semigloss][gloss].

6. Antiviral/Antibacterial Latex System :

a. Prime Coat: [Interior latex primer sealer][Interior, institutional low-odor/VOC primer sealer][Interior alkyd primer sealer].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [eggshell][semigloss].

7. Alkyd over Latex Sealer System :

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [flat][low sheen][semigloss][gloss].

8. Water-Based Alkyd System :

a. Prime Coat: Interior latex primer for wood.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [low sheen][semigloss][gloss].

3.9 INTERIOR PAINTING SCHEDULE, MISCELLANEOUS SUBSTRATES

A. Fiberglass Substrates:

1. Latex System :

a. Prime Coat: [Solvent-based bonding primer][Water-based bonding primer].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [flat][low sheen][eggshell][satin][semigloss][gloss].

2. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: [Water-based bonding primer][Solvent-based bonding primer].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [flat][low sheen][eggshell][satin][semigloss][gloss].

3. High-Performance Architectural Latex System :

a. Prime Coat: [Solvent-based bonding primer][Water-based bonding primer].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [low sheen][eggshell][satin][semigloss].

4. Water-Based Light Industrial Coating System :

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a. Prime Coat: [**Solvent-based bonding primer**][**Water-based bonding primer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based, light industrial coating, [**low sheen**][**semigloss**][**gloss**].

5. Antiviral/Antibacterial Latex System :

a. Prime Coat: [**Interior latex primer sealer**][**Interior, institutional low-odor/VOC primer sealer**][**Interior alkyd primer sealer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

6. Alkyd System :

a. Prime Coat: [**Solvent-based bonding primer**][**Water-based bonding primer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

7. Water-Based Alkyd System :

a. Prime Coat: [**Solvent-based bonding primer**][**Water-based bonding primer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

B. Plastic Trim Fabrication Substrates:

1. Latex System :

a. Prime Coat: [**Solvent-based bonding primer**][**Water-based bonding primer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Water-based bonding primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. High-Performance Architectural Latex System :

a. Prime Coat: [**Solvent-based bonding primer**][**Water-based bonding primer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

4. Water-Based Light Industrial Coating System :

a. Prime Coat: [**Solvent-based bonding primer**][**Water-based bonding primer**].
b. Intermediate Coat: Matching topcoat.

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c. Topcoat: Interior, water-based, light industrial coating, [**low sheen**][**semigloss**][**gloss**].

5. Antiviral/Antibacterial Latex System :

a. Prime Coat: [**Interior latex primer sealer**][**Interior, institutional low-odor/VOC primer sealer**][**Interior alkyd primer sealer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

6. Alkyd System :

a. Prime Coat: Solvent-based bonding primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

7. Water-Based Alkyd System :

a. Prime Coat: [**Solvent-based bonding primer**][**Water-based bonding primer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [**low sheen**][**semigloss**][**gloss**].

C. Spray-Textured Ceiling Substrates:

1. Latex, Flat System: Spray applied :

a. Prime Coat: Matching topcoat.
b. Topcoat: Interior latex paint, flat.

2. Latex System: Spray applied :

a. Prime Coat: Matching topcoat.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Latex over Alkyd Sealer System :

a. Prime Coat: Interior alkyd primer sealer
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. Alkyd, Flat System :

a. Prime Coat: Matching topcoat.
b. Topcoat: Interior alkyd paint, flat.

5. Alkyd over Alkyd Sealer System :

a. Prime Coat: Interior alkyd primer sealer.

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b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

D. Acoustic Panels and Tiles:

1. Latex, Flat System :

a. Prime Coat: Matching topcoat.
b. Topcoat: Interior latex paint, flat.

2. Latex over Alkyd Sealer System :

a. Prime Coat: Interior alkyd primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Matching topcoat.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

4. High-Performance Architectural Latex System :

a. Prime Coat: Matching topcoat.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, high-performance architectural latex, [**low sheen**][**eggshell**][**satin**][**semigloss**].

5. Antiviral/Antibacterial Latex System :

a. Prime Coat: [**Interior latex primer sealer**][**Interior, institutional low-odor/VOC primer sealer**][**Interior alkyd primer sealer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

6. Alkyd, Flat System :

a. Prime Coat: Matching topcoat.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, flat.

E. Canvas and Cotton Insulation-Covering Substrates: Including [**pipe and duct coverings**]<**Insert description**>.

1. Latex System :

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.

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c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Institutional Low-Odor/VOC Latex System :

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, institutional low odor/VOC, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

3. Antiviral/Antibacterial Latex System :

a. Prime Coat: [**Interior latex primer sealer**][**Interior, institutional low-odor/VOC primer sealer**][**Interior alkyd primer sealer**].
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, antiviral/antibacterial coating, [**eggshell**][**semigloss**].

4. Alkyd System :

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

5. Aluminum Paint System :

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Aluminum paint.

F. Bituminous-Coated Substrates:

1. Latex System :

a. Prime Coat: Water-based rust-inhibitive primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior latex paint, [**flat**][**low sheen**][**eggshell**][**satin**][**semigloss**][**gloss**].

2. Alkyd System :

a. Prime Coat: Water-based rust-inhibitive primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior alkyd paint, [**flat**][**low sheen**][**semigloss**][**gloss**].

3. Aluminum Paint System :

a. Prime Coat: Water-based rust-inhibitive primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Aluminum paint.

4. Water-Based Alkyd System :

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a. Prime Coat: Water-based, rust-inhibitive primer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, water-based alkyd paint, [low sheen][semigloss][gloss].

END OF SECTION 099123

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SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

a. Cutout dimensional characters.
b. Fabricated channel dimensional characters.
c. Illuminated, fabricated channel dimensional characters.
d. Molded-plastic dimensional characters.
e. Illuminated, molded-plastic dimensional characters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least [**half size**]<**Insert scale**>.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

E. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: [**Full-size Sample**][**Half-size Sample**]<**Insert size**> of[**each type of**] dimensional character.
2. Exposed Accessories: [**Full-size Sample**][**Half-size Sample**]<**Insert size**> of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

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F. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

G. Delegated Design Submittal: For [**signs indicated in "Performance Requirements" Article**]<**Insert sign designations**>.

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [**Installer**][**and**][**manufacturer**].

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: [**Manufacturer of products**][**An entity that employs installers and supervisors who are trained and approved by manufacturer**].

1.6 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: [**Five**]<**Insert number**> years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of [**rooftop**][**dimensional character**]<**Insert description**> sign type(s) <**Insert drawing designation of sign(s)**> according to structural performance requirements.

B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

1. Uniform Wind Load: [**As indicated on Drawings**]<**Insert design load**>.
2. Concentrated Horizontal Load: [**As indicated on Drawings**]<**Insert design load**>.
3. Other Design Load: [**As indicated on Drawings**]<**Insert design load**>
4. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: For exterior [**fabricated channel dimensional characters**]<**Insert item**>, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: [120 deg F, **ambient;** 180 deg F, **material surfaces**]<**Insert temperature change**>.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Brass Castings: ASTM B584, [**alloy recommended by manufacturer and finisher for finish indicated**][**lead-free alloy recommended by manufacturer and finisher for finish indicated**][**Alloy UNS No. C85200 (high-copper yellow brass)**]<**Insert requirement**>.

E. Brass Sheet (Yellow Brass): ASTM B36/B36M, [**alloy recommended by manufacturer and finisher for finish indicated**][**lead-free alloy recommended by manufacturer and finisher for finish indicated**][**Alloy UNS No. C26000 (yellow brass)**]<**Insert requirement**>.

F. Bronze Castings: ASTM B584, [**alloy recommended by manufacturer and finisher for finish indicated**][**lead-free alloy recommended by manufacturer and finisher for finish indicated**][**Alloy UNS No. C86500 (No. 1 manganese bronze)**]<**Insert requirement**>.

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G. Bronze Plate: ASTM B36/B36M, [**alloy recommended by manufacturer and finisher for finish indicated**][**lead-free alloy recommended by manufacturer and finisher for finish indicated**][**Alloy UNS No. C22000 (commercial bronze)**]<**Insert requirement**>.

H. Copper Sheet: ASTM B152/B152M.

I. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, [**Type 304,**][**Type 316,**] stretcher-leveled standard of flatness.

J. Zinc Castings: ASTM B240, alloy and temper recommended by sign manufacturer for type of use and finish indicated.

K. Zinc Sheet: [**ASTM B69**]<**Insert standard**>, alloy and temper recommended by sign manufacturer for type of use and finish indicated.

L. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

M. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish [**nonferrous-metal**][**stainless steel**][**or**][**hot-dip galvanized**]<**Insert requirement**> devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    b. Fastener Heads: For nonstructural connections, use [**flathead**][**or**][**oval countersunk**]<**Insert shape**> screws and bolts with tamper-resistant [**Allen-head**][**spanner-head**][**or**][**one-way-head**]<**Insert slot design**> slots unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

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c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

1. Adhesives shall have a VOC content of [70]<Insert value> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

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1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish [**to match sign-background color**][**to match Architect's sample**]<**Insert requirement**> color unless otherwise indicated.
2. Stainless Steel Brackets: Factory finish brackets [**to match sign background**][**to match Architect's sample**][**with No. 4**]<**Insert finish**> finish unless otherwise indicated.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, [**Class I, 0.018 mm**][**Class II, 0.010 mm**] or thicker.

B. Color Anodic Finish: AAMA 611, [**Class I, 0.018 mm**][**Class II, 0.010 mm**] or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
2. Directional Satin Finish: No. 4.
3. Dull Satin Finish: No. 6.
4. Reflective, Directional Polish: No. 7.
5. Mirrorlike Reflective, Nondirectional Polish: No. 8.

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2.8 LACQUER COATING FOR COPPER-ALLOY FINISHES

A. Lacquer Coating: Clear, organic, waterborne, air-drying, acrylic lacquer called "Incralac"; specially developed for coating copper-alloy products; consisting of a solution of acrylic resin, methyl methacrylate copolymer, leveling agent, and corrosion inhibitor benzotriazole.

PART 3 - EXECUTION (Not Used)

END OF SECTION 101419

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SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Private-use bathroom accessories.

B. Related Requirements:

1. Section 088300 "Mirrors" for frameless mirrors.
2. Section 093013 "Ceramic Tiling" for ceramic toilet and bath accessories.
3. Section 102813.63 "Detention Toilet Accessories" for accessories designed for installation in detention facilities.

1.2 ACTION SUBMITTALS

A. Product Data: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: For each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

D. Delegated Design Submittals: For [grab bars][and][shower seats].

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

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1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: [10][15]<Insert number> years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Toilet-Compartment Occupancy-Indicator Systems: Manufacturer agrees to repair or replace toilet-compartment occupancy-indicator systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: [Five]<Insert number> years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: [Two][Five][10]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: <Insert products>.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

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1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist [250 lbf][360 lbf]<Insert load> concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain [public-use washroom accessories][each type of public-use washroom accessory] from single source from single manufacturer.

B. Toilet Tissue (Roll) Dispenser:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

    a. [Aluids; Krome USA Inc.]
    b. [ASI-American Specialties, Inc.]
    c. [Bobrick Washroom Equipment, Inc]
    d. [Bradley Corporation]
    e. [Brey-Krause Manufacturing Co.]
    f. [Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]
    g. [Seachrome Corporation]
    h. [Tubular Specialties Manufacturing, Inc.]
    i. <Insert manufacturer's name>

2. Description: [Roll-in-reserve dispenser with hinged front secured with tumbler lockset][Single-roll dispenser][Double-roll dispenser][Double-roll dispenser with shelf]<Insert description>.
3. Mounting: [Recessed][Partition mounted, serving two adjacent toilet compartments][Surface mounted].
4. Operation: [Noncontrol delivery with standard spindle][Noncontrol delivery with theft-resistant spindle][Spindleless with tension-spring controlled delivery][Spindleless with tension-spring controlled delivery and self-locking device extending through core that prevents core removal until roll is empty][Eccentric-shaped, molded-plastic spindle revolves one-half revolution per dispensing operation for controlled delivery; core cannot be removed until roll is empty]<Insert description>.
5. Capacity: Designed for [4-1/2- or 5-inch-][5-inch-]<Insert dimension> diameter tissue rolls.
6. Material and Finish: [Stainless steel, ASTM A480/A480M No. 4 finish (satin)][Chrome-plated zinc alloy (zamac) or steel][Satin-finish aluminum bracket with plastic spindle]<Insert material and finish>.

C. Grab Bar:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers

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offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [Aluids; Krome USA Inc.]
b. [ASI-American Specialties, Inc.]
c. [Bobrick Washroom Equipment, Inc]
d. [Bradley Corporation]
e. [Brey-Krause Manufacturing Co.]
f. [Construction Solutions]
g. [Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]
h. [Oatey Co.]
i. [ProFlo; a Ferguson Enterprises, Inc. brand]
j. [Seachrome Corporation]
k. [Tubular Specialties Manufacturing, Inc.]
l. <Insert manufacturer's name>

2. Mounting: Flanges with [concealed][exposed] fasteners.
3. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin)[on ends and slip-resistant texture in grip area].

4. OD: [1-1/4 inches][1-1/2 inches].
5. Configuration and Length: [As indicated on Drawings][Straight, 36 inches long]<Insert configuration and length>.

D. Hook:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [ASI-American Specialties, Inc.]
b. [Bobrick Washroom Equipment, Inc]
c. [Bradley Corporation]
d. [Brey-Krause Manufacturing Co.]
e. [Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.]
f. [Seachrome Corporation]
g. [Tubular Specialties Manufacturing, Inc.]
h. <Insert manufacturer's name>

2. Description: [Double-prong unit][Single-prong unit][Combination hat and coat hook][Combination door bumper and coat hook]<Insert description>.
3. Mounting: [Concealed][Exposed].
4. Material and Finish: [Polished chrome-plated brass][Polished chrome-plated zinc alloy (zamac)][Stainless steel, ASTM A480/A480M No. 4 finish (satin)][Stainless steel, ASTM A480/A480M No. 7 finish (polished)]<Insert material and finish>.

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2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain [**public-use shower room accessories**][**each type of public-use shower room accessory**] from single source from single manufacturer.

B. Shower Curtain Rod:

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**ASI-American Specialties, Inc.**]
b. [**Bobrick Washroom Equipment, Inc**]
c. [**Bradley Corporation**]
d. [**Brey-Krause Manufacturing Co.**]
e. [**Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.**]
f. [**Tubular Specialties Manufacturing, Inc.**]
g. <**Insert manufacturer's name**>

2. Description: [1-inch-][1-1/4-inch-] OD, straight rod.
3. Configuration: [**As indicated on Drawings**]<**Insert description**>.
4. Mounting Flanges: [**Exposed**][**Concealed**]<**Insert requirements**> fasteners; in [**manufacturer's standard material and finish**][**material and finish matching rod**]<**Insert requirements**>.
5. Rod Material and Finish: [**Stainless steel, ASTM A480/A480M No. 4 finish (satin)**][**Polished chrome-plated brass**]<**Insert material and finish**>.

2.5 PRIVATE-USE BATHROOM ACCESSORIES

A. Source Limitations: Obtain [**private-use bathroom accessories**][**each type of private-use bathroom accessory**] from single source from single manufacturer.

B. Private-Use Towel Bar:

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Aluids; Krome USA Inc.**]
b. [**ASI-American Specialties, Inc.**]
c. [**Basco, Inc**]
d. [**Bobrick Washroom Equipment, Inc**]
e. [**Bradley Corporation**]
f. [**Brey-Krause Manufacturing Co.**]
g. [**Franklin Brass; Liberty Hardware Manufacturing Corporation; Masco Corporation**]
h. [**Gamco Commercial Restroom Accessories; Bobrick Washroom**

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Equipment, Inc.]
i. [Ginger; Brasstech, Inc.; Masco Corporation]
j. [Seachrome Corporation]
k. [Taymor Industries Ltd.]
l. [Tubular Specialties Manufacturing, Inc.]
m. <Insert manufacturer's name>

2. Description: [3/4-inch- square tube with rectangular end brackets][3/4-inch- round tube with circular end brackets]<Insert description>.
3. Mounting: Flanges with [concealed][exposed] fasteners.
4. Length: [18 inches][24 inches][30 inches]<Insert dimension>.
5. Material and Finish: [Stainless steel, ASTM A480/A480M No. 4 finish (satin)][Stainless steel, ASTM A480/A480M No. 7 finish (polished)][Polished aluminum]<Insert material and finish>.

2.6 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of [six]<Insert number> keys to Owner's representative.

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PART 3 - EXECUTION

3.1 INSTALLATION OF TOILET, BATH, AND LAUNDRY ACCESSORIES

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

END OF SECTION 102800

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SECTION 102819 - TUB AND SHOWER ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framed shower doors and enclosures.
2. Frameless shower doors and enclosures.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for shower doors and enclosures.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For tub and shower doors and enclosures.

1. Include plans, elevations, sections, and attachment details.

D. Samples for Initial Selection: For each type of exposed finish.

E. Samples for Verification: For tub and shower doors and enclosures.

1. Each type of mounting and operating hardware; full size.
2. Glass and glazing; 12 inches square.
3. Trim; 12-inch lengths.

F. Product Schedule: For tub and shower doors and enclosures.[**Use same designations indicated on Drawings.**]

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

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1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tub and shower doors and enclosures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of tub and shower doors and enclosure as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Verify dimensions by field measurements before fabrication and indicate on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tub and shower doors and enclosures that fail in materials or workmanship within specified warranty period, without monetary limitation.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: [Two][Three]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FRAMELESS ENCLOSURES

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

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1. [Alumax Bath Enclosures]
2. [American Shower Door Corporation]
3. [Anzzi; a brand of SWCorp]
4. [Artistcraft Shower Doors]
5. [Basco, Inc]
6. [Century Bathworks]
7. [Fleurco Products Inc.]
8. [Hartung Glass Industries]
9. [HMI]
10. [PRL Glass Systems Inc.]
11. [Seawin Hospitality; Seawin Global]
12. [SouFlo]
13. [Southeastern Aluminum Products, LLC]
14. [VIGO Industries LLC]
15. <Insert manufacturer's name>

B. Frameless glass panels with mounting and operating hardware of types and sizes required to support imposed loads.

C. Hardware and Trim: Manufacturer's standard units as indicated and as required for complete installation.

1. Materials:

a. Aluminum:

1) Finish: [Clear anodic][Color anodic][Baked enamel or powder coat]<Insert finish>.
2) Color: [Silver][Gold][Black]<Insert color>.

b. Brass:

1) Finish: [Chrome][Satin chrome][Brass][Satin brass][Oil-rubbed brass][Bronze][Brushed bronze][Oil-rubbed bronze]<Insert finish>.

c. Stainless Steel Sheet and Plate:

1) Finish: [ASTM A480/A480M No. 4 directional satin finish][ASTM A480/A480M No. 6 dull satin finish][ASTM A480/A480M No. 7 reflective, directional finish]<Insert finish>.

d. Stainless Steel Tubing:

1) Finish: [180-Grit Polished Finish: Uniform, directionally textured finish][280-Grit Polished Finish: Fine finish][Polished and Buffed Finish: 320-grit finish followed by buffing]<Insert finish>.

a) Polished and Buffed Finish: Buff to [a high luster finish][a mirrorlike finish][match Architect's sample].

D. Bypass Doors: Sliding units suspended from extruded-aluminum header track by fully

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adjustable, sealed, heavy-duty ball-bearing rollers. Self-draining sill tracks with nylon panel guides. Molded jamb bumpers with concealed fasteners.

1. Door Pulls: [**Full-door-width, single-sided towel bars**][**Single-sided vertical blade handles**][**Single-sided knobs**]<**Insert type**>.
2. Safety Clip System: Manufacturer's standard safety device designed to prevent doors from falling off sliding track.

E. Sliding Door and Fixed In-Line Panel: Sliding unit with exposed, adjustable, heavy-duty rollers operating above full-span header bar. Door bottom guide, antilift fittings, stoppers, and mounts for fixed panel and header bar.

1. Door Pulls: Back-to-back, [**D-pull**][**mitered pull**][**ladder pull**][**C-pull**][**knob**]<**Insert type**>.
2. Sill Strip: Manufacturer's standard sill strip designed to direct dripping water back into the enclosure.

F. Swinging Doors: Hinged for [**90 degrees outwards swing, self-closing**][**90 degrees inwards and outwards swing, self-centering when doors are within 15 degrees of closed position**][**full rotation swing, self-centering when doors are within 15 degrees of closed position**]. Soft bulb seal or wipes; affixed to door to direct water back into enclosure and provide a tight water seal.

1. Hinges: [**Full-height piano**][**Side-hinged, 90-degree patch**][**Side-hinged, 135-degree patch**][**Side-hinged, 180-degree patch**][**Top-and-bottom pivots**].
2. Door Pulls: [**Single-sided**][**Back-to-back**], [**towel bar**][**D-pull**][**mitered pull**][**ladder pull**][**C-pull**][**knob**]<**Insert type**>.

    a. Towel Bar Length: [18 inches][24 inches][30 inches]<**Insert dimension**>.

G. Fixed Panels: [**Side**][**Top-and-bottom**] mounts; match hinges in material and finish.

H. Ventilating Transom: Rotating clamps centered on transom.

I. Glazing:

1. [**Clear**][**Clear obscured**][**Tinted**][**Patterned**]<**Insert glass**> fully tempered. Comply with requirements in Section 088000 "Glazing."
2. Safety glazing materials complying with 16 CFR 1201, Category II, with permanently etched identification acceptable to authorities having jurisdiction.

    a. Glass Nominal Thickness: [**As determined by manufacturer based on panel size**][**8 mm**][**10 mm**][**12 mm**]<**Insert thickness**>.
    b. Clear Glass: ASTM C1048, Type I, Quality-Q3, Class I (clear), Kind FT.

        1) Obscured Panels: [**Acid etched**][**Sandblasted**]<**Insert appearance**>.

    c. Tinted Glass: ASTM C1048, Type I, Quality-Q3, Class II, Kind FT.

        1) Color: [**Bronze**][**Green**]<**Insert color**>.

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d. Patterned Glass: ASTM C1048, Kind FT (fully tempered), Type II, Class 1 (clear), Form 3; Quality-Q6, Finish F1 (patterned, one side).

1) Pattern: [**Manufacturer's standard**][**Pattern P3 (random)**]<**Insert pattern**>.

e. Protective, Self-Cleaning, Glass Coating: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

J. Fasteners: Manufacturer's standard stainless steel or other noncorrosive fasteners.

K. Sealant: Mildew-resistant, single-component, nonsag, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, for Use NT.

1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

L. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B209.
b. Extrusions: ASTM B221.

2. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 302 or 304.
3. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 302 or 304.

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4. Copper-Alloy Sheet and Shapes: ASTM B36/B36M.
5. Copper-Alloy Extrusions: ASTM B455, alloy UNS No. C38500 (architectural brass).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare and install per manufacturer's written instructions unless more stringent requirements are contained in NGA's "GANA Glazing Manual."

B. Clean substrates, removing projections, filling voids, and sealing joints.

C. Set units level, plumb, and true to line, without warp or rack of frames and panels, and anchor securely in place.

D. Fasten components securely in place, with provisions for thermal movement. Install with concealed fasteners unless otherwise indicated.

E. Install components to drain and return water to tub or shower.

F. Install doors to produce smooth operation and tight fit at contact points.

G. Repair, refinish, or replace components damaged during installation.

3.2 TUB AND SHOWER DOOR AND ENCLOSURE HARDWARE SCHEDULE

A. <Insert schedule>.

END OF SECTION 102819

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SECTION 105500.16 - PRIVATE-DELIVERY POSTAL SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of postal specialty.

B. Shop Drawings: For postal specialties.

1. Include plans, elevations, sections, and attachment details.
2. Include identification sequence for compartments.
3. Include layout of identification text.
4. Include setting drawings, templates, and installation instructions for anchor bolts and other anchorages installed as part of the Work of other Sections.

C. Samples for Verification: For each type of exposed finish, prepared on 6-by-6-inch-square Samples.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For postal specialties and finishes to include in maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of hardware[**including electrical components**].
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: [**Five**]<**Insert number**> years from date of Substantial

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Completion.

PART 2 - PRODUCTS

2.1 FABRICATION

A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

B. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.

C. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

D. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.

E. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.

F. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.

G. Fabricate rack ladders to support indicated number of units to form a column of units.

H. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

2.2 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install postal specialties level and plumb, according to manufacturer's written instructions and roughing-in drawings.

1. Where dissimilar metals are in permanent contact with each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer for this purpose.
2. Where aluminum contacts grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.

B. Horizontal Mail Receptacles: Install horizontal mail receptacles with center of tenant-door lock cylinders not more than 48 inches and bottom of receptacles not less than 15 inches above finished floor.

1. Install removable-core and keyed-in door lock cylinders as required for each type of cylinder lock.
2. Install and align two rack ladders for the first column of mail receptacles and one rack ladder for each additional adjacent column of mail receptacles.

C. Vertical Mail Receptacles: Install vertical mail receptacles with center of master lock cylinder not more than 48 inches and bottom of receptacles not less than 15 inches above finished floor.

D. Pedestal-Mounted Postal Specialties: Anchor units with 1/2-inch- diameter, [**galvanized**][**stainless**]-steel anchor bolts with hooked ends.

E. Mail Collection Boxes: Install collection boxes with [**centerline of mail slots**][**handle of hopper doors**] not more than 48 inches above finished floor.

F. Freestanding Data Distribution Boxes: Locate freestanding data distribution boxes at locations indicated[**or, if not indicated, as directed by Architect**].

G. Rack-Ladder Data Distribution Boxes: Install and align two rack ladders for the first column of data distribution boxes and one rack ladder for each additional adjacent column of data distribution boxes.

END OF SECTION 105500.16

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SECTION 107313 - AWNINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 108316 "Banners" for ornamental fabrics for interior or exterior use.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for awnings.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, mounting heights, and attachment details.
2. Detail fabrication and assembly of awnings[**, including seam layout, spacing, and orientation of awning fabric**].
3. Include diagrams for power, signal, and control wiring.
4. Show locations for blocking, reinforcement, and supplementary structural support.
5. Graphics: Show text message, font, character sizes, and other graphic forms; character, word, and line spacing; margin widths; position of copy; and other information related to graphic design.

C. Samples: For each exposed product and for each color and texture specified.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of graphics[**on fabric**] and accessories involving color or finish selection.

E. Samples for Verification: For the following:

1. Awning Fabric: 12-inch- square section of fabric from dye lot to be used for the Work, with specified treatments applied. Mark face of fabric.
2. Graphics: Not less than 12-inch- square section showing graphics application method.
3. Seam, Edge, and Corner Condition: Not less than 12-inch- long section showing seam, edge, and corner treatment.

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4. Valance: Full-size unit, not less than 12 inches long.
5. Frame Finish: Not less than 6-inch lengths.

F. Product Schedule: For awnings. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For awnings to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 WARRANTY

A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including framework.
b. Deterioration of fabric including seam failure.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Faulty operation of operator.

2. Awning Warranty Period: [**Five**]<**Insert number**> years from date of Substantial Completion.
3. Fabric Warranty Period: [**Three**][**Five**][**Eight**][**12**]<**Insert number**> years from date of Substantial Completion.
4. Thread Warranty Period: [**Five**][**Eight**]<**Insert number**> years from date of

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Substantial Completion.

5. Graphics Warranty Period: Outdoor durability not less than [**five**][**three**]<**Insert number**> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: [120 deg F, **ambient;** 180 deg F, **material surfaces**]<**Insert temperature change**>.

B. Fire-Test-Response Characteristics: Provide awning fabrics with the fire-test-response characteristics indicated, as determined by testing identical products according to test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes [**NFPA 701**][**California Code of Regulations, Title 19**].
2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency for Flame-Spread Index of [**25**]<**Insert value**> or less.
3. Permanently attach label to each awning fabric indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals, and whether it requires retreatment after designated time period or cleaning.

2.2 FABRIC

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. <**Insert manufacturer's name**>

B. Fabric:

1. Fiber Content: [**Vinyl-laminated or -coated polyester mesh**][**Vinyl-laminated or -coated polyester**][**Acrylic-coated polyester**][**Resin-coated polyester**][**Vinyl-coated polyester/cotton blend**][**Acrylic-coated polyester/cotton blend**][**Resin-coated polyester/cotton blend**][**Solution-dyed acrylic**][**Solution-dyed modacrylic**][**Expanded PTFE**]<**Insert description**>.
2. Weight: <**Insert value**>.
3. Width: <**Insert dimension**>.
4. Solar-Optical Properties: <**Insert requirements**>.
5. Openness Factor: <**Insert number**> percent.

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6. UV-Light Blockage: <**Insert number**> percent.
7. Mildew Resistance: Showing no growth when tested according to ASTM G21.
8. Shrinkage: Not greater than [**0.1**][**0.5**][**1**]<**Insert number**> percent according to ASTM D1204.
9. Stretch Factor: Not less than [**0.4**][**1**][**4**]<**Insert number**> percent according to ASTM D4851.
10. Applied Treatment: [**Stain resistant**][**Mildew resistant**][**Polymer, flame resistant**][**Water repellent**][**Lamination**]<**Insert description**>.
11. Pattern and Color: [**Match Architect's samples**][**As selected by Architect from manufacturer's full range**][**As indicated in an awning schedule**]<**Insert color**>.

C. Seam Thread: [**100 percent expanded PTFE**][**100 percent bonded polyester**], UV-light, mildew, and rot resistant.

D. Decorative Trims: [**Borders**][**Braid and bindings**][**Cords**][**Fringe**][**Patterned edge; scalloped**][**Patterned edge; V-shaped**][**Streamers**][**Tassels**][**Welting**]<**Insert description**>.

1. Colors: [**As indicated by manufacturer's designations**][**Match Architect's samples**][**Matching or coordinating with awning fabric color**][**As selected by Architect from manufacturer's full range**][**As indicated in an awning schedule**]<**Insert colors**>.

E. Fringe: [**As indicated by manufacturer's designation for style and color**][**As indicated in awning schedule**]<**Insert description**>.

2.3 AWNING FRAME AND ACCESSORY MATERIALS

A. Steel:

1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
2. Steel Tubing: ASTM A500/A500M.
3. Galvanized Steel Tubing: ASTM A787/A787M.
4. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40).

B. Aluminum: Alloy and temper recommended by awning manufacturer for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.

1. Aluminum Plate and Sheet: ASTM B209.
2. Aluminum Extrusions: ASTM B221.
3. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, standard weight (Schedule 40).
4. Drawn Seamless Tubing: ASTM B210.

C. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, [**tamperproof, vandal- and theft-resistant,**]compatible, nonstaining materials. Provide as required for awning assembly,

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mounting, and secure attachment. Number as needed to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.

1. Wood Screws: ASME B18.6.1.
2. Lag Bolts: ASME B18.2.1.
3. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M,Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers, zinc coated.
4. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E488 conducted by a qualified independent testing and inspecting agency.
    a. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.
5. Adhesive-Bonded Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E1512 conducted by a qualified independent testing and inspecting agency.
    a. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.
6. Grommets: [**Zinc-coated brass, No. 2**][**Stainless steel, No. 2**]<**Insert description**>.
7. Lacing: [**100 percent polyester, braided No. 4**]<**Insert description**>.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.4 AWNING FABRIC FABRICATION

A. Fabrication: Reinforce wear points and hardware attachment points with [**nonwoven**][**mesh**][**polypropylene mesh**]<**Insert description**> webbing. Seam fabrics [**in locations indicated on the Drawings and**] as follows:

1. Fabric Edges and Seams:
    a. Fold and stitch selvedge and cut fabric edges.
    b. Hot cut and sealed.
    c. Radio-frequency welded.
    d. Adhesively bonded.
    e. Manufacturer's standard hemming and seaming methods.

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2. Fabric Attachment:

a. [Manufacturer's standard][Hem pockets][Screws][Staples].
b. Grommets.

1) Grommet Spacing: [6 inches o.c.]<Insert spacing>.

B. Fabric Insets: [Heat-sealed][Sewn-in] process.

C. Graphic Application: [Hand painting][Silk-screen printing][Heat color transfer][Vinyl film with pressure-sensitive adhesive backing][PVDF film with pressure-sensitive adhesive backing][PVF film with pressure-sensitive adhesive backing][Radio-frequency, heat-sealed vinyl film][Eradication][Cut-out lettering]<Insert description>.

1. Graphic Image: [As indicated on Drawings][As indicated in awning schedule].
2. Text Message: [As indicated on Drawings][As indicated in an awning schedule]<Insert text>.

a. Text Font: [Helvetica]<Insert style>.
b. Character Size: Minimum [1-inch-][1-foot-]<Insert dimension> high characters.
c. Character Colors: <Insert colors>.

3. Vinyl Film: [Calendered-vinyl film, not less than 3 mils thick, with pressure-sensitive adhesive backing][Cast-vinyl film, not less than 2 mils thick, with pressure-sensitive adhesive backing][Cast-vinyl reflective film, not less than 2 mils thick, with pressure-sensitive adhesive backing]<Insert description>.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install awnings[and motor controls] at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.

B. Install awnings after other finishing operations, including joint sealing and painting, have been completed.

C. Slip fit frame connections accurately together to form hairline joints, and tighten to secure.

D. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

1. Field Welding: Comply with the following requirements:

a. Use materials and methods that minimize distortion and develop strength

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and corrosion resistance of base metals.

b. Obtain fusion without undercut or overlap.
c. Remove welding flux immediately.
d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing awnings to structural support and for properly transferring load to in-place construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

G. Coordinate awning installation with flashing and joint-sealant installation so these materials are installed in sequence and in a manner that prevents exterior moisture from passing through completed exterior wall and roof assemblies.

3.2 DEMONSTRATION

A. [Engage a factory-authorized service representative to train][Train] Owner's maintenance personnel to adjust, operate, and maintain retractable awnings.

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SECTION 122113 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Horizontal louver blinds, polymer slats.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics,[**electrical characteristics,**] and furnished accessories.
3. <**Insert requirements**>.

B. Shop Drawings: For horizontal louver blinds.

1. Fabrication and installation details.
2. Diagrams for power, signal, and control wiring for motorized units.
3. <**Insert requirements**>.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type and color of horizontal louver blind.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: Actual sample of finished products for each type and color of horizontal louver blind.

1. Size: [**Manufacturers' standard size**]<**Insert size**>.

E. Product Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

F. Sustainable Design Submittals:

1. Product Certificates: For indigenous materials, indicating location of material

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manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For horizontal louver blinds with polymer slats that have been tested for compliance with NFPA 701, for tests performed by [**a qualified testing agency**][**manufacturer and witnessed by a qualified testing agency**].

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For horizontal louver blinds.

1.5 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of motorized products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

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a. Faulty operation of motorized operating system components.

2. Warranty Period: [5]<Insert number> year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Window Covering Safety Standard: Provide horizontal louver blinds that comply with WCMA A100.1[and are listed and labeled as "Best for Kids" by a qualified testing agency].

2.2 HORIZONTAL LOUVER BLINDS, POLYMER SLATS

A. Horizontal Louver Blinds, Polymer Slats:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [CACO, Inc.]
b. [Comfortex Window Fashions; Comfortex Corporation]
c. [Hunter Douglas Architectural]
d. [Springs Window Fashions; SWFcontract]
e. [TimberBlindsMetroShade; Timberblinds, LLC]
f. <Insert manufacturer's name>

B. Laboratory Test Reports: For product, indicating compliance with requirements for low-emitting materials.

C. Product Data: For product, indicating compliance with requirements for formaldehyde emissions.

D. Flame-Resistance Rating: Comply with NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Slats: Polymers that are lead free, UV stabilized, integrally colored, opaque, and will not crack or yellow; antistatic, dust-repellent treated.

1. Formulation: [Permanently flexible, extruded PVC][Foam PVC][Polymer/wood composite][Manufacturer's standard]<Insert formulation>.
2. Width: [2 inches][2-1/2 inches]<Insert dimension>.
3. Thickness: [0.125 inch]<Insert dimension>.
4. Spacing: [Manufacturer's standard]<Insert dimension>.
5. Profile: [Crowned][Manufacturer's standard]<Insert profile>.
6. Features:

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a. Privacy Slats: Manufacturer's standard privacy slats with no inner lift-cord route holes or with minimum size inner lift-cord route holes located near back (outside) edge of slat to maximize slat overlap and minimize light gaps between slats.
b. <**Insert description**>.

F. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.

1. Type: [**Braided cord**][**Cloth tape, manufacturer's standard width**]<**Insert description**>.

G. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose control mechanisms on three sides and ends.

1. Capacity: [**One**][**Two**] blind(s) per headrail unless otherwise indicated.

H. Manual Corded Operation:

1. Lift Mechanism:

a. Lift-Cord Lock: [**Variable; stops lift cord at user-selected position within full operating range**][**Top locking; stops lift cord when blind is in fully opened or fully closed positions only; equipped with ring pull not more than 4 inches long**].

2. Lift Operator: Extension of inner lift cord(s) through lift-cord lock mechanism to form lift cord.
3. Lift Cord: Manufacturer's standard braided cord.
4. Lift-Cord Length: [**Short cord, not greater than 8 inches when blind is fully closed**][**Inaccessible cord, not greater than 12 inches when blind is fully closed**].
5. Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
6. Tilt Position:

a. Full.
b. [**One**][**Two**]-direction, positive stop or lockout limited at an angle of [**20**][**60**][**80**]<**Insert number**> degrees from horizontal[**, both directions**].

7. Tilt Operator: [**Clear-plastic wand**][**Corrosion-resistant steel rod**][**Inaccessible dual cord**]<**Insert description**>.
8. Tilt Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over-rotation of gear.
9. Tilt-Operator Length, Wand or Rod: [**24 inches**][**30 inches**][**36 inches**][**48 inches**]<**Insert length**>.
10. Tilt-Operator Length, Cord: Inaccessible dual cord, not greater than **12 inches** in length in all phases of operation.
11. Lift-Cord and Tilt-Operator Locations: [**Manufacturer's standard**][**Right side and left side of headrail, respectively,**][**Left side and right side of headrail, respectively,**][**Right side of headrail**][**Left side of headrail**] unless otherwise indicated.

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I. Manual Cordless Operation:

1. Lift Mechanism: Manufacturer's standard lift- or tension-control mechanism that allows blinds to be raised or lowered into position by manually pushing the bottom rail up or pulling it down.
2. Lift Operator: [**Manufacturer's standard**][**Plastic lip on bottom rail for manually raising/lowering blinds**][**Bottom rail, no lip**][**Lift-and-lock button on bottom rail for manually raising/lowering blinds when pressed and held, and locking blinds into position when released**].
3. Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
4. Tilt Position:

    a. Full.
    b. [**One**][**Two**]-direction, positive stop or lockout limited at an angle of [**20**][**60**][**80**]<**Insert number**> degrees from horizontal[**, both directions**].

5. Tilt Operator: [**Clear-plastic wand**][**Corrosion-resistant steel rod**]<**Insert description**>.
6. Tilt Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over-rotation of gear.
7. Tilt-Operator Length: [12 inches][24 inches][30 inches][36 inches][48 inches]<**Insert length**>.
8. Tilt-Operator Location: [**Manufacturer's standard**][**Right side of headrail**][**Left side of headrail**] unless otherwise indicated.

J. Motorized Operation: Provide factory-assembled motorized blinds with blind-operator systems of size and capacity, and with features, characteristics, and accessories required for conditions indicated. Coordinate electrical requirements with building electrical system.

1. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FDDR; including UL 325.
3. Function: Tilt.
4. Power: [**Battery, 12 V dc**][**Manufacturer's standard**]<**Insert requirements**>.
5. Motor Type: Radio frequency.
6. Operation, Radio Frequency: [**Two**]<**Insert number**> Manufacturer's standard [**multichannel**][**single-channel**] remote-control handheld transmitter for operation of up to [**12**]<**Insert number**> individual blinds or up to [**6**]<**Insert number**> groups of blinds and with operating features as follows:

    a. Tilt slats open; tilt slats closed both directions.
    b. Tilt slats up at 45 degrees from horizontal; tilt slats down at 45 degrees from horizontal.
    c. Tilt slats to stop at any angle.
    d. Tilt slats to programmable preset tilt position.
    e. Phone- or tablet-control app integration with automated timed programming

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capability.
f. Override switch.
g. Color: [**Manufacturer's standard**][**White**][**Black**].
h. <**Insert description**>.

7. Travel Limit/Stop: Adjustable control, interlocked with motor controls and set to stop blind automatically at slats fully closed tilted down and slats fully closed tilted up.
8. Provide power disconnect switch.
9. Manual Corded Lift:

a. Lift Mechanism:

1) Lift-Cord Lock: [**Variable; stops lift cord at user-selected position within blind full operating range**][**Top locking; stops lift cord when blind is in fully opened or fully closed positions only; equipped with ring pull not more than 4 inches long**].

b. Lift Operator: Extension of inner lift cord(s) through lift-cord lock mechanism to form lift cord.
c. Lift Cord: Manufacturer's standard braided cord.
d. Lift-Cord Length: [**Short cord, not greater than 8 inches when blind is fully closed**][**Inaccessible cord, not greater than 12 inches when blind is fully closed**].
e. Lift-Cord Location: [**Manufacturer's standard**][**Right side of headrail**][**Left side of headrail**] unless otherwise indicated.

10. Manual Cordless Lift:

a. Lift Mechanism: Manufacturer's standard lift- or tension-control mechanism that allows blinds to be raised or lowered into position by manually pushing the bottom rail up or pulling it down.
b. Lift Operator: Lift and lock button on bottom rail for manually raising/lowering blinds when pressed and held, and locking blinds into position when released.

K. Bottom Rail: Secures and protects ends of ladders and inner lift cords.

1. Type: [**Manufacturer's standard**][**Formed-steel or extruded-aluminum tube, with plastic or metal capped ends**][**Hardwood matching slats and trapezoid-shaped bottom angled for minimizing light gaps**][**Manufacturer's standard enclosing lift-and-lock control mechanisms on three sides**]<**Insert type**>.

L. Valance: [**Manufacturer's standard**]<**Insert description**>.

M. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.

1. Type: [**Wall**][**Overhead**][**End**][**Wall extension**][**Two piece for pocket installation**][**As indicated**]<**Insert description**>.
2. Intermediate Support: Provide intermediate support brackets to produce support

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spacing recommended by horizontal louver blind manufacturer for weight and size of blind.

N. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

O. Colors, Textures, Patterns, and Gloss:

1. Slats: [**Match Architect's samples**][**Match Architect's samples for custom color and other characteristics**][**As selected by Architect from manufacturer's full range**][**As indicated**]<**Insert description**>.
2. Components: [**Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated**]<**Insert description**>.

2.3 FABRICATION OF HORIZONTAL LOUVER BLINDS

A. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at **74 deg F**:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less **1/4 inch** per side or **1/2 inch** total, plus or minus **1/8 inch**. Length equal to head-to-sill dimension of opening in which blind is installed less **1/4 inch**, plus or minus **1/8 inch**.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

C. Mounting Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind mounting method indicated.

D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

E. Color-Coated Finish:

1. Metal: For components exposed to view, unless anodized or plated finish is indicated, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
2. Wood: Apply [**manufacturer's standard**]<**Insert description**> factory-applied finish complying with manufacturer's written instructions for surface preparation, application, and minimum dry film thickness.

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PART 3 - EXECUTION

3.1 INSTALLATION OF HORIZONTAL LOUVER BLINDS

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units in accordance with manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than [1 inch][2 inches]<**Insert dimension**> from interior faces of glass and not closer than [1/2 inch][1-1/2 inches]<**Insert dimension**> from interior faces of glazing frames [**at top and bottom**][**at one side and bottom**] through full operating ranges of blinds.
2. Install mounting brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

B. Electrical Connections: Connect motorized operators to building electrical system.

3.2 DEMONSTRATION

A. [**Engage a factory-authorized service representative to train**][**Train**] Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 122113

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SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking for anchoring casework.
2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.
3. Section 123623.13 "Plastic-Laminate-Clad Countertops."
4. Section 123640 "Stone Countertops."
5. Section 123661 "Simulated Stone Countertops."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components, and profiles and finishes for casework.
2. Include rated capacities, operating characteristics, profiles, and finishes for hardware.

B. Sustainable Design Submittals:

1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
4. Laboratory Test Reports: For composite wood products, indicating compliance with the formaldehyde emissions evaluation.

C. Shop Drawings:

1. Include plans, elevations, details, and attachments to other work.
2. Show materials, finishes, filler panels, and hardware.
3. Indicate manufacturer's catalog numbers for casework.

D. Samples: For casework and hardware finishes.

E. Samples for Initial Selection: For casework and hardware finishes.

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F. Samples for Verification: For the following:

1. Casework Finishes: 8-by-10-inch Samples for each type of casework finish.
2. Hardware: One full-size Sample of each type of exposed hardware in each finish required.
3. Base Cabinet: One full-size, [16-inch-]<**Insert dimension**> wide, finished base cabinet complete with hardware, doors, and drawers but without countertop.
4. Wall Cabinet: One full-size, [12-inch-]<**Insert dimension**> wide, finished wall cabinet complete with hardware, doors, and adjustable shelves.
5. Full-Size Samples: Maintain at Project site during construction in an undisturbed condition as a standard for judging the completed Work. Unless otherwise indicated, approved sample units may become part of the completed Work if in undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For casework.

1.4 QUALITY ASSURANCE

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where casework is indicated to fit to other construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

1. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

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PART 2 - PRODUCTS

2.1 CABINET MATERIALS

A. Hardwood Lumber: Kiln dried to 7 percent moisture content.

B. Softwood Lumber: Kiln dried to 10 percent moisture content.

C. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:

1. Hardwood Plywood: 0.05 ppm.
2. Particleboard: 0.09 ppm.
3. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
4. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.

D. Hardwood Plywood: HPVA HP-1.

E. Particleboard: ANSI A208.1, Grade M-2.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert number**> percent.

F. MDF: Medium-density fiberboard, ANSI A208.2, Grade MD.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert number**> percent.

G. Hardboard: ANSI A135.4, Class 1 tempered.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert number**> percent.

H. Adhesives: Do not use adhesives that contain urea formaldehyde.

I. Exposed Materials:

1. Exposed Wood Species:
[**Oak**][**Maple**][**Alder**][**Birch**][**Hickory**][**Cherry**][**Manufacturer's standard domestic hardwood species**]<**Insert requirements**>.

a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
b. Staining and Finish: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**].

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A

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faces and Grade C backs of same species as faces.

a. Edge band exposed edges with [**a minimum of 1/8-inch- thick, solid-wood**][**veneer**] edging of same species as face veneer.

4. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with ISO 4586, Grade VGS and edgebanded.

a. Colors, Textures, and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from cabinet manufacturer's full range**]<**Insert requirements**>.
b. Plastic-Laminate Edgebanding: Of same grade, pattern, color, and texture of plastic laminate as for faces.
c. PVC Edgebanding: Rigid PVC extrusions, through color with satin finish, [**3 mm thick at doors and drawer fronts, and 1 mm thick elsewhere**][**1 mm thick**].

1) Color: [**As indicated by manufacturer's designation**][**Match Architect's sample**][**As selected by Architect from cabinet manufacturer's full range**]<**Insert requirements**>.

5. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.

a. Provide material finished on both sides for doors and drawer fronts.
b. Provide [**PVC or polyester edgebanding**][**PVC edge molding**] on components with exposed or semiexposed edges.
c. Colors: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from cabinet manufacturer's full range**]<**Insert requirements**>.

6. Thermoformed-Vinyl-Faced Panels: MDF, milled to required shapes, with a thermoformed vinyl overlay applied in a vacuum or membrane press.

a. Color: [**White**][**As indicated by manufacturer's designation**][**Match Architect's sample**][**As selected by Architect from cabinet manufacturer's full range**]<**Insert requirements**>.

J. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces[**or stained to be compatible with exposed surfaces**].
2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces[**or stained to be compatible with exposed surfaces**].
3. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with ISO 4586, Grade VGS.

a. For backs of doors and drawer fronts faced with plastic laminate, provide same grade, pattern, color, and texture of plastic laminate as for faces.

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b. For face frames faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces.
c. For shelves faced with plastic laminate, provide [**plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces**][**PVC edge molding, 1 mm thick**].
d. Colors, Textures, and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from cabinet manufacturer's full range**]<**Insert requirements**>.

4. Thermally Fused Laminate Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.

a. Provide material finished on both sides for shelves, dividers, drawer bodies, and other components with two semiexposed surfaces.
b. Provide [**PVC or polyester edgebanding**][**PVC edge molding**] on components with semiexposed edges.
c. Colors: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from cabinet manufacturer's full range**]<**Insert requirements**>.

5. Vinyl-Faced Particleboard: MDF with[**embossed, wood-grain-patterned**] vinyl film adhesively bonded to particleboard.

a. Provide vinyl film on both sides of shelves, dividers, drawer bodies, and other components with two semiexposed surfaces and on semiexposed edges.
b. Colors, Textures, and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from cabinet manufacturer's full range**]<**Insert requirements**>.

K. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

PART 3 - EXECUTION

3.1 INSTALLATION OF RESIDENTIAL CASEWORK

A. Install casework with no variations in adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework.

B. Install casework without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.

C. Install casework level and plumb to a tolerance of 1/8 inch in 8 ft..

D. Fasten casework to adjacent units and to backing.

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1. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c.

    a. Fasteners: [**No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips**][**No. 10 wafer-head sheet metal screws through the metal backing or metal framing behind the wall finish**][**Toggle bolts through the metal backing or metal framing behind the wall finish**].

END OF SECTION 123530

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SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Sustainable Design Submittals:

1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
2. Environmental Product Declaration: For each product.
3. Third-Party Certifications: For each product.
4. Third-Party Certified Life Cycle Assessment: For each product.
5. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
6. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
7. Product Data: For installation adhesives, indicating VOC content.
8. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.
9. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.

C. Shop Drawings: For plastic-laminate-clad countertops.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
3. Apply [**AWI Quality Certification**][**WI Certified Compliance**] Program label to Shop Drawings.

D. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

E. Samples for Initial Selection: For plastic laminates.

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F. Samples for Verification: As follows:

1. Plastic Laminates: For each type, color, pattern, and surface finish required, [8 by 10 inches][12 by 12 inches] in size.
2. Wood-Grain Plastic Laminates: For each type, color, pattern, and surface finish required, [12 by 24 inches][24 by 24 inches] in size.
3. Fabrication Sample: For each type and profile of countertop required, provide one sample applied to core material with specified edge material applied to one edge.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [**Installer**][**fabricator**].

B. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.
3. Chemical-resistant, high-pressure decorative laminate.
4. Adhesives.

C. Quality Standard Compliance Certificates: [**AWI Quality Certification Program**][**WI Certified Compliance Program**].

D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: [**AWI's Quality Certification Program accredited participant**][**WI's Certified Compliance Program licensee**].

B. Installer Qualifications: [**Fabricator of products**][**AWI's Quality Certification Program accredited participant**][**WI's Certified Compliance Program licensee**].

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

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1.6 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between [25 and 55][43 and 70][20 and 50]<Insert numbers> percent during the remainder of the construction period.

C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Fabricators: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. <Insert, in separate subparagraphs, names and contact information for preapproved woodworking firms>.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: [5 to 10][8 to 13][4 to 9] percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

1. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D 6007 or ASTM E 1333:

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a. Hardwood Plywood: 0.05 ppm.
b. Particleboard: 0.09 ppm.
c. MDF More Than 5/16 Inch Thick: 0.11 ppm.
d. MDF 5/16 Inch or Less in Thickness: 0.13 ppm.

2. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <**Insert value**> percent.
3. MDF: Medium-density fiberboard, ANSI A208.2, [**Grade 130**]<**Insert grade**>.
4. Particleboard: ANSI A208.1, [**Grade M-2**][**Grade M-2-Exterior Glue**].
5. Softwood Plywood: DOC PS 1.

2.3 MISCELLANEOUS MATERIALS

A. Adhesives: Do not use adhesives that contain urea formaldehyde.

B. Adhesive for Bonding Plastic Laminate: [**Unpigmented contact cement**][**Contact cement**][**PVA**][**Resorcinol**][**As selected by fabricator to comply with requirements**].

1. Adhesive for Bonding Edges: Hot-melt adhesive[**or adhesive specified above for faces**].

C. Installation Adhesive:

1. Adhesives shall have a VOC content of [**70**]<**Insert value**> g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.4 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times countertop fabrication will be complete.

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2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.

D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

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E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
2. Secure backsplashes [to tops with concealed metal brackets at 16 inches o.c.][and][to walls with adhesive].
3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

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SECTION 123661 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for cantilever supports.
2. Section 224100 "Residential Plumbing Fixtures" and Section 224200 "Commercial Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of countertop material[**and sink**].

B. Shop Drawings:

1. Plans, sections, details, edge and backsplash profiles, and attachment to other work.
2. Locations and details of joints.
3. Locations, quantity, and type of supports/brackets.
4. Direction of directional pattern, if any.
5. Locations and sizes of cutouts and holes for items installed in countertop.
6. Apply [**AWI's Quality Certification**][**WI's Certified Compliance**] Program label to Shop Drawings.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification:

1. Countertop material, 6 inches square.
2. One full-size countertop, with front edge[**and backsplash**], 8 by 10 inches, of construction and in configuration specified.

E. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Indicate locations and sizes of cutouts and holes for items

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installed in countertops or backsplashes.

B. Qualification Statements: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include product data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 MOCKUPS

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as indicated on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of countertops by field measurements[**after base cabinets are installed but**] before countertop fabrication is complete and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work..

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Quality Standard: Unless otherwise indicated, comply with [**ANSI/AWI 1236**][**NAAWS**] for grades of simulated stone countertops indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from [**AWI**][**WI**] certification program indicating that countertops

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comply with requirements of grade specified.

2. The Contract Documents contain more stringent requirements than that of the referenced quality standard. Comply with requirements of the Contract Documents in addition to those of referenced quality standard.

2.2 SOLID SURFACE MATERIAL COUNTERTOPS

A. Solid Surface Countertop Type :

1. Grade: [**Premium**][**Custom**][**Economy**][**Match related casework**].

B. Solid Surface Material: Homogeneous fabrication of mineral fillers and pigments bound together with a matrix of polymers and resins, complying with ISFA 2-01.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

a. [**Affinity Surfaces; a brand of Domain Industries, Inc.**]
b. [**Avonite Surfaces; a Brand of Aristech Surfaces LLC**]
c. [**DuPont; DuPont de Nemours, Inc.**]
d. [**Durasein Solid Surface; a brand of Relang International, LLC**]
e. [**Formica Corporation**]
f. [**LG Hausys, Ltd.**]
g. [**Lotte Chemical Co., LTD**]
h. [**Meganite Inc.**]
i. [**Swan Surfaces LLC (Swanstone)**]
j. [**Transolid**]
k. [**Wilsonart LLC**]
l. <**Insert manufacturer's name**>

2. Colors and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's samples**][**As selected by Architect from manufacturer's full range**].
3. Countertop:

a. Type: [**Standard**][**Special Purpose**][**Veneer**].
b. Thickness:

1) [1/2-inch-][3/4-inch-] thick, solid surface material[**with front edge built up with same material**].

c. Exposed Edge Treatment: [**Bevel**][**Ogee**][**Radius**][**As selected by Architect from manufacturer's full range**]<**Insert style**>.
d. Provide drip groove [1/8 inch by 1/8 inch set back 3/8 inch]<**Insert groove size and location**> from front edge of countertop.
e. Backsplash: [**Integral coved**][**Detached straight**].

1) Height: [4 inches]<**Insert height**>.
2) Thickness: [1/2 inch][**Matching countertop**].

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f. End Splash: [**Matching backsplash**][**None**].

4. Sink Bowls:

a. [**Integral**][**Top Mounted**][**Separate unit for under-counter mounting**].
b. Material: [**PMMA**][**Acrylic**][**Composite**][**Enameled cast iron**][**Enameled steel**][**Solid surface**][**Stainless steel**][**Vitreous china**]<**Insert type**>.
c. Shape: [**Oval**][**Rectangle**]<**Insert type**>.
d. Color: [**White**][**Match countertop**]<**Insert color**>.

2.3 FABRICATION

A. Fabricate countertops in sizes and shapes required to comply with requirements indicated.

B. Fabricate tops with shop-applied edges[**and backsplashes**] unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

C. Joints:

1. Fabricate countertops without joints.
2. Fabricate countertops in sections for joining in field[**, with joints at locations indicated**].

a. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
b. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints[**where indicated**]. Make width of cuts slightly more than thickness of splines to provide snug fit.[**Provide at least three splines in each joint.**]

D. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures[**in shop**] using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.

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2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for grommets, plumbing fittings, undercounter soap dispensers, and similar items.
4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.4 INSTALLATION MATERIALS

A. Particleboard: ANSI A208.1, [Grade M-2][Grade M-2-Exterior Glue].

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

1. Laboratory Test Reports: For composite wood products, indicating compliance with the formaldehyde emissions evaluation.
2. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:

a. Hardwood Plywood: 0.05 ppm.
b. Particleboard: 0.09 ppm.
c. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
d. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.

C. Adhesive: Product recommended by manufacturer.

1. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

D. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION OF SIMULATED STONE COUNTERTOPS

A. Grade: Install countertops to comply with specified grade.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts not finished in the shop. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required

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for clearance. Ease edges slightly to prevent snipping.

C. Countertop Installation:

1. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
3. Anchor wall cleating necessary for proper setting for countertops not supported by casework.
4. Install countertops level to a tolerance of 1/8 inch in 8 ft., 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
5. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
6. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
7. Secure countertops to subtops with adhesive according to manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
8. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

    a. Install metal splines in kerfs in countertop edges at joints[**where indicated**]. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
    b. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

9. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
10. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
11. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls. Comply with Section 079200 "Joint Sealants."

END OF SECTION 123661

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SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. [**Recessed**][**Surface-mounted**] frames.

B. Related Requirements:

1. Section 124816 "Entrance Floor Grilles" for rigid floor grilles and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Shop Drawings:

1. Items penetrating floor mats and frames, including door control devices.
2. Divisions between mat sections.
3. Perimeter floor [**moldings**][**frames**].
4. Custom Graphics: Scale drawing indicating colors.

C. Samples: For the following products, in manufacturer's standard sizes:

1. Floor Mat: Assembled sections of floor mat.
2. Tread Rail: Sample of each type and color.
3. Frame Members: Sample of each type and color.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:

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1. Uniform floor load of [300 lbf/sq. ft.]<**Insert value**>.
2. Wheel load of [350 lb]<**Insert value**> per wheel.

B. Accessibility Standard: Comply with applicable provisions in [**the DOJ's "2010 ADA Standards for Accessible Design"**][**and**][**ICC A117.1**]<**Insert regulation**>.

2.2 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.3 Cocoa Mats

A. Basis-of-Design Product: Subject to compliance with requirements, provide <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

1. [**van Gelder, Inc**]
2. <**Insert manufacturer's name**>

2.4 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Surface-Mounted Frames: As indicated for permanent surface-mounted installation, complete with corner connectors, splice plates or connecting pins, and postinstalled expansion anchors.

D. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.5 ALUMINUM FINISHES

A. Mill finish.

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B. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.

C. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

2.6 COPPER-ALLOY (BRONZE) FINISHES

A. Finish designations prefixed by CDA comply with the system established by the Copper Development Association for designating copper-alloy finishes, as defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

    a. Run grain of directional finishes with long dimension of each piece.

B. CDA Mechanical Finish Designation: [**M11, specular, as fabricated**][**M32, directionally textured, medium satin**].

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

1. For installation in terrazzo flooring areas, allow for grinding and polishing of terrazzo without grinding surface of recessed frames. Coordinate with other trades as required.
2. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
3. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.
4. Delay setting mats until construction traffic has ended.

B. Install surface-type units to comply with manufacturer's written instructions; coordinate with entrance locations and traffic patterns.

1. Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer.

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END OF SECTION 124813

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SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Motors.
2. Packless expansion joints.
3. Alignment guides and anchors.
4. Sleeves without waterstop.
5. Grout.
6. Silicone sealants.
7. Escutcheons.
8. Thermometers, filled system, lead free.
9. Thermometers, liquid in glass, lead free.
10. Thermometers, light activated, lead free.
11. Thermowells, lead free.
12. Pressure gauges, dial type, lead free.
13. Gauge attachments, lead free.

B. Related Requirements:

1. Section 221119 "Domestic Water Piping Specialties" for water meters.
2. Section 221513 "General-Service Compressed-Air Piping" for compressed air gauges.
3. Section 331415 "Site Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product, excluding motors which are included in Part 1 of the plumbing equipment Sections.

    a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
    b. Include operating characteristics and furnished accessories.

B. Delegated Design Submittals: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing

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connections.

2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of [**expansion joint,**][**and**][**gauge**] to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water[**expansion fittings and loops**] for plumbing piping intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.

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C. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.2 ESCUTCHEONS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. [**BrassCraft Manufacturing Co.; a Masco company**]
2. [**Dearborn Brass**]
3. [**Jones Stephens Corp.**]
4. [**Keeney Manufacturing Company (The)**]
5. [**Mid-America Fittings, LLC; A Midland Industries Company**]
6. [**ProFlo; a Ferguson Enterprises, Inc. brand**]
7. <**Insert manufacturer's name**>

B. Escutcheon Types:

1. One-Piece, Steel Type: With [**polished, chrome-plated**][**polished brass**] finish and setscrew fastener.
2. One-Piece, Stainless Steel Type: With polished stainless steel finish.
3. One-Piece, Cast-Brass Type: With [**polished, chrome-plated**][**polished brass**] finish and setscrew fastener.
4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped [**steel**][**brass**] with polished, chrome-plated finish and spring-clip fasteners.
5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; [**concealed**][**and**][**exposed-rivet**] hinge; and spring-clip fasteners.

C. Floor Plates:

1. Split Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION JOINTS, GENERAL

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

3.2 INSTALLATION OF PACKLESS EXPANSION JOINTS

A. Install metal-bellows expansion joints in accordance with EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

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B. Install rubber packless expansion joints in accordance with FSA-PSJ-703.

3.3 INSTALLATION OF GROOVED-JOINT EXPANSION JOINTS

A. Install grooved-joint expansion joints to grooved-end steel piping.

3.4 INSTALLATION OF ALIGNMENT GUIDES AND ANCHORS

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install [one][two] guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than [four]<Insert number> pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9.
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-58, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
3. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

3.5 INSTALLATION OF PIPE LOOP AND SWING CONNECTIONS

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least [five]<Insert number> pipe fittings, including tee in main.

C. Connect risers and branch connections to terminal units with at least [four]<Insert number> pipe fittings, including tee in riser.

D. Connect mains and branch connections to terminal units with at least [four]<Insert number> pipe fittings, including tee in main.

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3.6 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide [1-inch][2-inch]<**Insert dimension**> annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas [2 inches]<**Insert dimension**> above finished floor level.

3. Using [**grout**][**or**][**silicone sealant**], seal the space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.7 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

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D. Using [grout][or][silicone sealant], seal space around outside of sleeves. Select to maintain fire resistance of floor/slab/wall.

3.8 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.9 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.10 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.11 INSTALLATION OF METERS AND GAUGES

A. Install thermometer with thermowell at each required thermometer location.

B. Install thermowells in vertical position in piping tees.

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C. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

D. Install thermowells with extension on insulated piping.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

G. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks.

H. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at most readable position.

I. Install remote-mounted pressure gauges on panel.

J. Install valve and snubber in piping for each pressure gauge for fluids.

K. Install test plugs in piping tees.

L. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.
5. Outlet side of hot-water-balancing valve.
6. Each main hot-water-recirculating line return pipe.
7. <Insert location>.

M. Install pressure gauges in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.
4. <Insert location>.

3.12 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:

1. Perform the following tests and inspections:

a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

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2. Prepare test and inspection reports.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.13 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:

a. Sleeves with waterstops.

1) Select sleeve size to allow for [1-inch]<**Insert dimension**> annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:

a. Sleeves with waterstops.

1) Select sleeve size to allow for [1-inch]<**Insert dimension**> annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

a. [**Sleeves with waterstops**][**or**][**stack-sleeve fittings**].

4. Interior Wall and Partitions:

a. Sleeves without waterstops.

3.14 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping and Relocated Existing Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Chrome-Plated Piping: One piece, [**steel**][**cast brass**][**or split-casting brass**] with polished, chrome-plated finish.
3. Insulated Piping:

a. One piece, steel with [**polished, chrome-plated**][**polished brass**] finish.
b. One piece, stainless steel with polished stainless steel finish.
c. One piece, cast brass with [**polished, chrome-plated**][**polished brass**] finish.
d. One piece, stamped steel [**or split plate, stamped steel with concealed hinge**][**or split plate, stamped steel with exposed-rivet hinge**] with polished, chrome-plated finish.

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4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:

    a. One piece, steel with [**polished, chrome-plated**][**polished brass**] finish.
    b. One piece, stainless steel with polished stainless steel finish.
    c. One piece, cast brass with [**polished, chrome-plated**][**polished brass**] finish.
    d. One piece, stamped steel [**or split plate, stamped steel with concealed hinge**][**or split plate, stamped steel with exposed-rivet hinge**] with polished, chrome-plated finish.

5. Bare Piping at Ceiling Penetrations in Finished Spaces:

    a. One piece, steel with [**polished, chrome-plated**][**polished brass**] finish.
    b. One piece, stainless steel with polished stainless steel finish.
    c. One piece, cast brass with [**polished, chrome-plated**][**polished brass**] finish.
    d. One piece, stamped steel [**or split plate, stamped steel with concealed hinge**][**or split plate, stamped steel with exposed-rivet hinge**] with polished, chrome-plated finish.

6. Bare Piping in Unfinished Service Spaces:

    a. One piece, steel with polished, chrome-plated finish.
    b. One piece, cast brass with [**polished, chrome-plated**][**rough-brass**] finish.
    c. One piece, stamped steel [**or split plate, stamped steel with concealed hinge**][**or split plate, stamped steel with exposed-rivet hinge**] with polished, chrome-plated finish.

7. Bare Piping in Equipment Rooms:

    a. One piece, steel with polished, chrome-plated finish.
    b. One piece, cast brass with [**polished, chrome-plated**][**rough-brass**] finish.
    c. One piece, stamped steel [**or split plate, stamped steel with concealed hinge**][**or split plate, stamped steel with exposed-rivet hinge**] with polished, chrome-plated finish.

B. Escutcheons for Existing Piping to Remain:

1. Chrome-Plated Piping: Split casting, stamped steel with [**concealed**][**or**][**exposed-rivet**] hinge with polished, chrome-plated finish.
2. Insulated Piping: Split plate, stamped steel with [**concealed**][**or**][**exposed-rivet**] hinge with polished, chrome-plated finish
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split plate, stamped steel with [**concealed**][**or**][**exposed-rivet**] hinge with polished, chrome-plated finish.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split plate, stamped steel with [**concealed**][**or**][**exposed-rivet**] hinge with polished, chrome-plated finish.
5. Bare Piping in Unfinished Service Spaces: Split plate, stamped steel with [**concealed**][**or**][**exposed-rivet**] hinge with polished, chrome-plated finish.
6. Bare Piping in Equipment Rooms: Split plate, stamped steel with [**concealed**][**or**][**exposed-rivet**] hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

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D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping and Relocated Existing Piping: One piece, floor plate.
2. Existing Piping: Split floor plate.

3.15 THERMOMETER, LEAD FREE, APPLICATION

A. Thermometers at inlet and outlet of each domestic water heater are to be the following:

1. [**Liquid-filled**][**Sealed**], bimetallic-actuated type.
2. [**Direct**][**Remote**]-mounted, [**metal**][**plastic**]-case, vapor-actuated type.
3. [**Metal**][**Plastic**] case, [**compact**][**industrial**]-style, liquid-in-glass type.
4. [**Direct**][**Remote**]-mounted, light-activated type.
5. Test plug with [**chlorosulfonated polyethylene synthetic**][**EPDM**] self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each domestic water heat exchanger are to be the following:

1. [**Liquid-filled**][**Sealed**], bimetallic-actuated type.
2. [**Direct**][**Remote**]-mounted, [**metal**][**plastic**]-case, vapor-actuated type.
3. [**Metal**][**Plastic**] case, [**compact**][**industrial**]-style, liquid-in-glass type.
4. [**Direct**][**Remote**]-mounted, light-activated type.
5. Test plug with [**chlorosulfonated polyethylene synthetic**][**EPDM**] self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank are to be the following:

1. [**Liquid-filled**][**Sealed**], bimetallic-actuated type.
2. [**Direct**][**Remote**]-mounted, [**metal**][**plastic**]-case, vapor-actuated type.
3. [**Metal**][**Plastic**] case, [**compact**][**industrial**]-style, liquid-in-glass type.
4. [**Direct**][**Remote**]-mounted, light-activated type.
5. Test plug with [**chlorosulfonated polyethylene synthetic**][**EPDM**] self-sealing rubber inserts.

D. Thermometers at inlet and outlet of each remote domestic water chiller are to be the following:

1. [**Liquid-filled**][**Sealed**], bimetallic-actuated type.
2. [**Direct**][**Remote**]-mounted, [**metal**][**plastic**]-case, vapor-actuated type.
3. [**Metal**][**Plastic**] case, [**compact**][**industrial**]-style, liquid-in-glass type.
4. [**Direct**][**Remote**]-mounted, light-activated type.
5. Test plug with [**chlorosulfonated polyethylene synthetic**][**EPDM**] self-sealing rubber inserts.

E. Thermometer stems are to be of length to match thermowell insertion length.

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3.16 THERMOMETER, LEAD FREE, SCALE-RANGE APPLICATION

A. Scale Range for Domestic Cold-Water Piping:

1. [0 to 100 deg F][0 to 100 deg F and minus 20 to plus 50 deg C].
2. [0 to 150 deg F][0 to 150 deg F and minus 20 to plus 70 deg C].
3. [30 to 240 deg F][30 to 240 deg F and 0 to plus 115 deg C].

B. Scale Range for Domestic Hot-Water Piping:

1. [0 to 250 deg F][0 to 250 deg F and 0 to 150 deg C].
2. [20 to 240 deg F][20 to 240 deg F and 0 to 150 deg C].
3. [30 to 240 deg F][30 to 240 deg F and 0 to plus 115 deg C].

C. Scale Range for Domestic Cooled-Water Piping:

1. [0 to 100 deg F][0 to 100 deg F and minus 20 to plus 50 deg C].
2. [0 to 150 deg F][0 to 150 deg F and minus 20 to plus 70 deg C].

D. Insert additional paragraphs for thermometer scale ranges and applications.

3.17 PRESSURE-GAUGE APPLICATION

A. Pressure gauges at discharge of each water service into building are to be the following:

1. [Liquid filled][Sealed][Open front, pressure relief][Solid front, pressure relief]<Insert type>, [direct][remote] mounted, metal case.
2. [Sealed]<Insert type>, [direct][remote] mounted, plastic case.
3. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

B. Pressure gauges at inlet and outlet of each water pressure-reducing valve are to be the following:

1. [Liquid filled][Sealed][Open front, pressure relief][Solid front, pressure relief]<Insert type>, [direct][remote] mounted, metal case.
2. [Sealed]<Insert type>, [direct][remote] mounted, plastic case.
3. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

C. Pressure gauges at suction and discharge of each domestic water pump are to be the following:

1. [Liquid filled][Sealed][Open front, pressure relief][Solid front, pressure relief]<Insert type>, [direct][remote] mounted, metal case.
2. [Sealed]<Insert type>, [direct][remote] mounted, plastic case.
3. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

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3.18 PRESSURE-GAUGE SCALE-RANGE APPLICATION

A. Scale Range for Water Service Piping:

1. [0 to 100 psi][0 to 100 psi and 0 to 600 kPa].
2. [0 to 160 psi][0 to 160 psi and 0 to 1100 kPa].
3. [0 to 200 psi][0 to 200 psi and 0 to 1400 kPa].

B. Scale Range for Domestic Water Piping:

1. [0 to 100 psi][0 to 100 psi and 0 to 600 kPa].
2. [0 to 160 psi][0 to 160 psi and 0 to 1100 kPa].
3. [0 to 200 psi][0 to 200 psi and 0 to 1400 kPa].
4. [0 to 300 psi][0 to 300 psi and 0 to 2500 kPa].

C. Insert additional paragraphs for pressure-gauge scale ranges and applications.

END OF SECTION 220500

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SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Butterfly valves.
3. Check valves.
4. Gate valves.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include material descriptions and dimensions of individual components.
b. Include operating characteristics and furnished accessories.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic-water piping valves intended to convey or dispense water for human consumption must comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372; or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for cast-copper solder-joint connections.
6. ASME B16.22 for wrought-copper solder-joint connections.
7. ASME B16.34 for flanged- and threaded-end connections.

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8. ASME B16.51 for press joint connections.
9. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

H. Valve Actuator Type:

1. Gear Actuator: For quarter-turn ball valves [NPS 4]<**Insert pipe size**> and larger.
2. Hand Lever: For quarter-turn ball valves smaller than [NPS 4]<**Insert pipe size**>.

I. Valves in Insulated Piping:

1. Provide 2-inch extended neck stems.
2. Provide extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Provide memory stops that are fully adjustable after insulation is applied.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide support of piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position that does not project into aisles or block access to other equipment.

F. Install valves in position to allow full stem and actuator or manual operator movement.

G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.

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H. Chainwheels: Install chainwheels on manual operators for [**butterfly**][**globe**][**and**][**gate**] valves [NPS 4]<**Insert pipe size**> and larger and more than [96 inches]<**Insert dimension**> above floor. Extend chains to [60 inches]<**Insert dimension**> above finished floor.

I. Install check valves for proper direction of flow and as follows:

1. Check Valves: [**Center-guided type**][**and**][**plate type**], in horizontal or vertical position, between flanges.
2. Check Valves, Swing Type: In horizontal position with hinge pin level.
3. Check Valves, Lift Type: With stem upright and plumb.

J. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

K. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's written recommended maximum.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
7. For Stainless Steel Piping, NPS 2 (DN 50) and Smaller: [**Threaded**][**Press**] ends.
8. For Stainless Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends.
9. For Grooved-End Copper Tubing: Valve ends may be grooved.
10. For Grooved-End Steel Piping: Valve ends may be grooved.
11. Wafer-Type Valves: Flanged connections.

3.3 LOW-PRESSURE, COMPRESSED-AIR BALL VALVE SCHEDULE - 150 PSIG (1035 kPa) OR LESS

A. Pipe NPS 2 (DN 50) and Smaller:

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1. Ball valves, threaded or soldered ends - brass, three piece with full port and brass trim; [**threaded**][**soldered**] ends.
2. Ball valves, threaded or soldered ends - brass, three piece with full port and stainless steel trim; [**threaded**][**soldered**] ends.
3. Ball valves, threaded or soldered ends - brass, two piece with full port and brass trim; [**threaded**][**soldered**] ends.
4. Ball valves, threaded or soldered ends - brass, two piece with full port and stainless steel trim; [**threaded**][**soldered**] ends.
5. Ball valves, threaded or flanged ends - stainless steel, two piece with full port; [**threaded**][**flanged**] ends.
6. Ball valves, threaded ends - bronze, two piece, safety exhaust; [200 psig]<**Insert pressure**>.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Ball valves, flanged ends - steel, with full port and stainless steel trim, Class 150.
2. Ball valves, flanged ends - steel, with full port and stainless steel trim, Class 300.
3. Ball valves, flanged ends - iron, Class 125.
4. Ball valves, threaded or flanged ends - stainless steel, two piece with full port; [**threaded**][**flanged**] ends.

3.4 HIGH-PRESSURE, COMPRESSED-AIR BALL VALVE SCHEDULE - 150 TO 200 PSIG (1035 TO 1380 kPa)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball valves, threaded or soldered ends - brass, three piece with full port and brass trim; [**threaded**][**soldered**] ends.
2. Ball valves, threaded or soldered ends - brass, three piece with full port and stainless steel trim; [**threaded**][**soldered**] ends.
3. Ball valves, threaded or soldered ends - brass, two piece with full port and brass trim; [**threaded**][**soldered**] ends.
4. Ball valves, threaded or soldered ends - brass, two piece with full port and stainless steel trim; [**threaded**][**soldered**] ends.
5. Ball valves, threaded or flanged ends - stainless steel, two piece with full port; [**threaded**][**flanged**] ends.
6. Ball valves, threaded ends - bronze, two piece, safety exhaust; [200 psig]<**Insert pressure**>.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Ball valves, flanged ends - steel, with full port and stainless steel trim, Class 150.
2. Ball valves, flanged ends - steel, with full port and stainless steel trim, Class 300.
3. Ball valves, flanged ends - iron, Class 125.
4. Ball valves, threaded or flanged ends - stainless steel, two piece with full port; [**threaded**][**flanged**] ends.

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3.5 DOMESTIC HOT- AND COLD-WATER BALL VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball valves, lead free, threaded ends - brass, one piece.
2. Ball valves, lead free, threaded or soldered ends - brass, two piece with full port and brass trim; [**threaded**][**soldered**] ends.
3. Ball valves, lead free, threaded or soldered ends - brass, two piece with full port and stainless steel trim; [**threaded**][**soldered**] ends.
4. Ball valves, lead free, threaded or soldered ends - brass, two piece with regular port and brass trim; [**threaded**][**soldered**] ends.
5. Ball valves, lead free, threaded or soldered ends - brass, two piece with regular port and stainless steel trim; [**threaded**][**soldered**] ends.
6. Ball valves, lead free, threaded or soldered ends - brass, three piece with full port and brass trim; [**threaded**][**soldered**] ends.
7. Ball valves, lead free, threaded or soldered ends - brass, three piece with full port and stainless steel trim; [**threaded**][**soldered**] ends.
8. Ball valves, lead free, threaded ends - bronze, one piece with bronze trim.
9. Ball valves, lead free, threaded ends - bronze, one piece with stainless steel trim.
10. Ball valves, lead free, threaded or soldered ends - bronze, two piece with full port and bronze or brass trim; [**threaded**][**soldered**] ends.
11. Ball valves, lead free, threaded or soldered ends - bronze, two piece with full port and stainless steel trim; [**threaded**][**soldered**] ends.
12. Ball valves, lead free, threaded ends - bronze, two piece with regular port and bronze or brass trim.
13. Ball valves, lead free, threaded ends - bronze, two piece with regular port and stainless steel trim.
14. Ball valves, lead free, threaded ends - bronze, three piece with full port and bronze or brass trim.
15. Ball valves, lead free, threaded ends - bronze, three piece with full port and stainless steel trim.
16. Ball valves, lead free, threaded or soldered ends - bronze, three piece with regular port and bronze or brass trim; [**threaded**][**soldered**] ends.
17. Ball valves, lead free, threaded or soldered ends - bronze, three piece with regular port and stainless steel trim; [**threaded**][**soldered**] ends.
18. Ball valves, lead free, threaded or flanged ends - stainless steel, two piece with full port; [**threaded**][**flanged**] ends.
19. Ball valves, lead free, press ends - brass, two piece with full port and brass trim.
20. Ball valves, lead free, press ends - brass, two piece with full port and stainless steel trim.
21. Ball valves, lead free, press ends - bronze, two piece with full port and bronze or brass trim.
22. Ball valves, lead free, press ends - stainless steel, two piece with full port.
23. Ball valves, lead free, flanged or threaded ends - steel, with full port, Class 150; [**threaded**][**flanged**] ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Ball valves, lead free, flanged or threaded ends - iron, Class 125; [**flanged**][**threaded**] ends.

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2. Ball valves, lead free, flanged or threaded ends - steel, with full port, Class 150; [**flanged**][**threaded**] ends.
3. Ball valves, lead free, flanged or threaded ends - steel, with regular port, Class 150; [**flanged**][**threaded**] ends.
4. Ball valves, threaded or flanged ends - stainless steel, two piece with full port; [**threaded**][**flanged**] ends.

C. For CPVC Pipe:

1. CPVC Union-Type Ball Check Valve: [**NPS 2 and smaller**][**NPS 4 and smaller**][**125 psig**][**150 psig**]<**Insert pressure**> at [**73 deg F**]<**Insert temperature**>.

   a. End Connections for Valves NPS 2 (DN 50) and Smaller: [**Socket**][**or**][**threaded**].
   b. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [**Socket**][**Socket or threaded**][**Threaded**][**Flanged**].

D. For PVC Pipe:

1. PVC Union-Type Ball Check Valve: [**NPS 2 and smaller**][**NPS 4 and smaller**][**125 psig**][**150 psig**]<**Insert pressure**> at [**73 deg F**]<**Insert temperature**>.

   a. End Connections for Valves NPS 2 (DN 50) and Smaller: [**Socket**][**or**][**threaded**].
   b. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): [**Socket**][**Socket or threaded**][**Threaded**][**Flanged**].

3.6 LOW-PRESSURE, COMPRESSED-AIR BUTTERFLY VALVE SCHEDULE - 150 PSIG (1035 kPa) OR LESS

A. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Butterfly valves, single flange (lug type) - iron, with aluminum-bronze disc; [**150**][**200**] CWP, NBR seat.
2. Butterfly valves, single flange (lug type) - iron, with ductile-iron disc; [**150**][**200**] CWP, NBR seat.
3. Butterfly valves, single flange (lug type) - iron, with stainless steel disc; [**150**][**200**] CWP, NBR seat.
4. Butterfly valves, flangeless (wafer type) - iron, with aluminum-bronze disc; [**150**][**200**] CWP, NBR seat.
5. Butterfly valves, flangeless (wafer type) - iron, with ductile-iron disc; [**150**][**200**] CWP, NBR seat.
6. Butterfly valves, flangeless (wafer type) - iron, with stainless steel disc; [**150**][**200**] CWP, NBR seat.
7. Butterfly valves, grooved end - ductile iron, 175 CWP; NBR seat.
8. Butterfly valves, grooved end - ductile iron, 300 CWP; NBR seat.
9. Butterfly valves, grooved end - stainless steel; NBR seat.

3.7 HIGH-PRESSURE, COMPRESSED-AIR BUTTERFLY VALVE SCHEDULE - 150 TO

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200 PSIG (1035 TO 1380 kPa)

A. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Butterfly valves, single flange (lug type) - iron, with aluminum-bronze disc; 200 CWP, NBR seat.
2. Butterfly valves, single flange (lug type) - iron, with ductile-iron disc; 200 CWP, NBR seat.
3. Butterfly valves, single flange (lug type) - iron, with stainless steel disc; 200 CWP, NBR seat.
4. Butterfly valves, flangeless (wafer type) - iron, with aluminum-bronze disc; 200 CWP, NBR seat.
5. Butterfly valves, flangeless (wafer type) - iron, with ductile-iron disc; 200 CWP, NBR seat.
6. Butterfly valves, flangeless (wafer type) - iron, with stainless steel disc; 200 CWP, NBR seat.
7. Butterfly valves, grooved end - ductile iron, 175 CWP; NBR seat.
8. Butterfly valves, grooved end - ductile iron, 300 CWP; NBR seat.
9. Butterfly valves, grooved end - stainless steel; NBR seat.

3.8 DOMESTIC HOT- AND COLD-WATER BUTTERFLY VALVE SCHEDULE

A. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Butterfly valves, lead free, single flange (lug type) - iron, with aluminum-bronze disc; [150][200] CWP, [EPDM][NBR] seat.
2. Butterfly valves, lead free, single flange (lug type) - iron, with ductile-iron disc; [150][200] CWP, [EPDM][NBR] seat.
3. Butterfly valves, lead free, single flange (lug type) - iron, with stainless steel disc; [150][200] CWP, [EPDM][NBR] seat.
4. Butterfly valves, lead free, flangeless (wafer type) - iron, with aluminum-bronze disc; [150][200] CWP, [EPDM][NBR] seat.
5. Butterfly valves, lead free, flangeless (wafer type) - iron, with ductile-iron disc; [150][200] CWP, [EPDM][NBR] seat.
6. Butterfly valves, lead free, flangeless (wafer type) - iron, with stainless steel disc; [150][200] CWP, [EPDM][NBR] seat.
7. Butterfly valves, lead free, grooved end - ductile iron, 175 CWP; [EPDM][NBR] seat.
8. Butterfly valves, lead free, grooved end - ductile iron, 300 CWP; [EPDM][NBR] seat.

B. For CPVC Pipe: CPVC butterfly valve for [NPS 2-1/2][NPS 5] and larger.

C. For PVC Pipe: PVC butterfly valve for [NPS 2-1/2][NPS 5] and larger.

D. For Stainless Steel Pipe: Stainless steel, grooved-end butterfly valve for NPS 2-1/2 and larger.

3.9 LOW-PRESSURE, COMPRESSED-AIR CHECK VALVE SCHEDULE - 150 PSIG

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(1035 kPa) OR LESS

A. Pipe NPS 2 (DN 50) and Smaller:

1. Vertical, Upflow Applications Only:

a. Check valves, lift type, threaded or soldered ends - bronze, with bronze disc, Class 125; [**threaded**][**soldered**] ends.
b. Check valves, lift type, threaded or soldered ends - bronze, with nonmetallic disc, Class 125; [**threaded**][**soldered**] ends.

2. Horizontal and Vertical Applications:

a. Check valves, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125; [**threaded**][**soldered**] ends.
b. Check valves, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 125; [**threaded**][**soldered**] ends.
c. Check valves, swing type, threaded or soldered ends - bronze, with bronze disc, Class 150; [**threaded**][**soldered**] ends.
d. Check valves, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 150; [**threaded**][**soldered**] ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Check valves, swing type, flanged ends - iron, with metal seats, Class 125.
2. Check valves, swing type, flanged ends - iron, with nonmetallic-to-metal seats, Class 125.
3. Check valves, swing type, flanged ends - iron, with metal seats, Class 250.
4. Check valves, swing type, grooved ends - iron, 300 CWP.
5. Check valves, dual-plate type - iron, with metal seat, Class 125.
6. Check valves, dual-plate type - iron, with metal seat, Class 150.
7. Check valves, dual-plate type - iron, with metal seat, Class 250.
8. Check valves, dual-plate type - iron, with metal seat, Class 300.
9. Check valves, dual-plate type - iron, with resilient seat, Class 125.
10. Check valves, dual-plate type - iron, with resilient seat, Class 150.
11. Check valves, dual-plate type - iron, with resilient seat, Class 250.
12. Check valves, dual-plate type - iron, with resilient seat, Class 300.
13. Check valves, single-plate type - iron, with resilient seat, Class 125; NBR seat.
14. Check valves, single-plate type - iron, with resilient seat, Class 250; NBR seat.

3.10 HIGH-PRESSURE, COMPRESSED-AIR CHECK VALVE SCHEDULE - 150 TO 200 PSIG (1035 TO 1380 kPa)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Vertical, Upflow Applications Only:

a. Check valves, lift type, threaded or soldered ends - bronze, with bronze disc, Class 125; [**threaded**][**soldered**] ends.
b. Check valves, lift type, threaded or soldered ends - bronze, with

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nonmetallic disc, Class 125; [**threaded**][**soldered**] ends.

2. Horizontal and Vertical Applications:

   a. Check valves, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125; [**threaded**][**soldered**] ends.
   b. Check valves, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 125; [**threaded**][**soldered**] ends.
   c. Check valves, swing type, threaded or soldered ends - bronze, with bronze disc, Class 150; [**threaded**][**soldered**] ends.
   d. Check valves, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 150; [**threaded**][**soldered**] ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Check valves, swing type, flanged ends - iron, with metal seats, Class 125.
2. Check valves, swing type, flanged ends - iron, with nonmetallic-to-metal seats, Class 125.
3. Check valves, swing type, flanged ends - iron, with metal seats, Class 250.
4. Check valves, swing type, grooved ends - iron, 300 CWP.
5. Check valves, dual-plate type - iron, with metal seat, Class 125.
6. Check valves, dual-plate type - iron, with metal seat, Class 150.
7. Check valves, dual-plate type - iron, with metal seat, Class 250.
8. Check valves, dual-plate type - iron, with metal seat, Class 300.
9. Check valves, dual-plate type - iron, with resilient seat, Class 125.
10. Check valves, dual-plate type - iron, with resilient seat, Class 150.
11. Check valves, dual-plate type - iron, with resilient seat, Class 250.
12. Check valves, dual-plate type - iron, with resilient seat, Class 300.
13. Check valves, single-plate type - iron, with resilient seat, Class 125; NBR seat.
14. Check valves, single-plate type - iron, with resilient seat, Class 250; NBR seat.

3.11 DOMESTIC HOT- AND COLD-WATER CHECK VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125; [**threaded**][**soldered**] ends.
2. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 125; [**threaded**][**soldered**] ends.
3. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 150; [**threaded**][**soldered**] ends.
4. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 150; [**threaded**][**soldered**] ends.
5. Check valves, lead free, swing type, press ends - bronze.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Check valves, lead free, swing type, flanged or threaded ends - iron, with metal seats, Class 125; [**flanged**][**threaded**] ends.
2. Check valves, lead free, swing type, flanged or threaded ends - iron, with

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nonmetallic-to-metal Seats, Class 125; [**flanged**][**threaded**] ends.

3. Check valves, lead free, swing type, flanged or threaded ends - iron, with metal seats, Class 250; [**flanged**][**threaded**] ends.
4. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever- and spring-closure control, Class 125; [**flanged**][**threaded**] ends.
5. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever- and weight-closure control, Class 125; [**flanged**][**threaded**] ends.
6. Check valves, lead free, swing type, grooved ends - iron, 300 CWP.
7. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 125.
8. Check valves, lead free, center guided - iron, globe, with metal seat, Class 125.
9. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 150.
10. Check valves, lead free, center guided - iron, globe, with metal seat, Class 150.
11. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 250.
12. Check valves, lead free, center guided - iron, globe, with metal seat, Class 250.
13. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 300.
14. Check valves, lead free, center guided - iron, globe, with metal seat, Class 300.
15. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 125; [**EPDM**][**or**][**NBR**] seat.
16. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 125; [**EPDM**][**or**][**NBR**] seat.
17. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 150; [**EPDM**][**or**][**NBR**] seat.
18. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 150; [**EPDM**][**or**][**NBR**] seat.
19. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 250; [**EPDM**][**or**][**NBR**] seat.
20. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 250; [**EPDM**][**or**][**NBR**] seat.
21. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 300; [**EPDM**][**or**][**NBR**] seat.
22. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 300; [**EPDM**][**or**][**NBR**] seat.
23. Check valves, lead free, dual-plate type - iron, with metal seat, Class 125.
24. Check valves, lead free, dual-plate type - iron, with metal seat, Class 150.
25. Check valves, lead free, dual-plate type - iron, with metal seat, Class 250.
26. Check valves, lead free, dual-plate type - iron, with metal seat, Class 300.
27. Check valves, lead free, single-plate type - iron, with resilient seat, Class 125; [**EPDM**][**or**][**NBR**] seat.
28. Check valves, lead free, dual-plate type - iron, with resilient seat, Class 125; [**EPDM**][**or**][**NBR**] seat.
29. Check valves, lead free, dual-plate type - iron, with resilient seat, Class 150; [**EPDM**][**or**][**NBR**] seat.
30. Check valves, lead free, single-plate type - iron, with resilient seat, Class 250; [**EPDM**][**or**][**NBR**] seat.
31. Check valves, lead free, dual-plate type - iron, with resilient seat, Class 250; [**EPDM**][**or**][**NBR**] seat.

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32. Check valves, lead free, dual-plate type - iron, with resilient seat, Class 300; [EPDM][or][NBR] seat.

C. For CPVC Pipe:

1. NPS 2 (DN 50) and Smaller: [Union][Non-union] ball valve.
2. NPS 4 (DN 100) and Smaller: [Union][Non-union] ball valve.

D. For PVC Pipe:

1. NPS 2 (DN 50) and Smaller: [Union][Non-union] ball valve.
2. NPS 4 (DN 100) and Smaller: [Union][Non-union] ball valve.

3.12 PUMP-DISCHARGE CHECK VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125; [threaded][soldered] ends.
2. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 125; [threaded][soldered] ends.
3. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 150; [threaded][soldered] ends.
4. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 150; [threaded][soldered] ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger for Domestic Water Pumps:

1. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever- and spring-closure control, Class 125; [flanged][threaded] ends.
2. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever- and weight-closure control, Class 125; [flanged][threaded] ends.
3. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 125.
4. Check valves, lead free, center guided - iron, globe, with metal seat, Class 125.
5. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 150.
6. Check valves, lead free, center guided - iron, globe, with metal seat, Class 150.
7. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 250.
8. Check valves, lead free, center guided - iron, globe, with metal seat, Class 250.
9. Check valves, lead free, center guided - iron, compact wafer, with metal seat, Class 300.
10. Check valves, lead free, center guided - iron, globe, with metal seat, Class 300.
11. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 125; [EPDM][or][NBR] seat.
12. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 125; [EPDM][or][NBR] seat.
13. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 150; [EPDM][or][NBR] seat.

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14. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 150; [EPDM][or][NBR] seat.
15. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 250; [EPDM][or][NBR] seat.
16. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 250; [EPDM][or][NBR] seat.
17. Check valves, lead free, center guided - iron, compact wafer, with resilient seat, Class 300; [EPDM][or][NBR] seat.
18. Check valves, lead free, center guided - iron, globe, with resilient seat, Class 300; [EPDM][or][NBR] seat.

C. Pipe NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage:

1. Check valves, swing type, flanged ends - iron, with lever- and spring-closure control, Class 125.
2. Check valves, swing type, flanged ends - iron, with lever- and weight-closure control, Class 125.

3.13 LOW-PRESSURE, COMPRESSED-AIR GATE VALVE SCHEDULE - 150 PSIG (1035 kPa) OR LESS

A. Pipe NPS 2 (DN 50) and Smaller:

1. Gate valves, threaded or soldered ends - bronze, NRS, Class 125; [threaded][soldered] ends.
2. Gate valves, threaded or soldered ends - bronze, RS, Class 125; [threaded][soldered] ends.
3. Gate valves, threaded ends - bronze, NRS, Class 150.
4. Gate valves, threaded ends - bronze, RS, Class 150.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Gate valves, flanged ends - iron, NRS, Class 125.
2. Gate valves, flanged ends - iron, OS&Y, Class 125.
3. Gate valves, flanged ends - iron, NRS, Class 250.
4. Gate valves, flanged ends - iron, OS&Y, Class 250.

3.14 HIGH-PRESSURE, COMPRESSED-AIR GATE VALVE SCHEDULE - 150 TO 200 PSIG (1035 TO 1380 kPa)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Gate valves, threaded or soldered ends - bronze, NRS, Class 125; [threaded][or][soldered] ends.
2. Gate valves, threaded or soldered ends - bronze, RS, Class 125; [threaded][or][soldered] ends.
3. Gate valves, threaded ends - bronze, NRS, Class 150.
4. Gate valves, threaded ends - bronze, RS, Class 150.

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B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Gate valves, flanged ends - iron, NRS, Class 125.
2. Gate valves, flanged ends - iron, OS&Y, Class 125.
3. Gate valves, flanged ends - iron, NRS, Class 250.
4. Gate valves, flanged ends - iron, OS&Y, Class 250.

3.15 DOMESTIC HOT- AND COLD-WATER GATE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Gate valves, lead free, threaded or soldered ends - bronze, NRS, Class 125; [threaded][or][soldered] ends.
2. Gate valves, lead free, threaded or soldered ends - bronze, RS, Class 125; [threaded][or][soldered] ends.
3. Gate valves, lead free, threaded ends - bronze, NRS, Class 150.
4. Gate valves, lead free, threaded ends - bronze, RS, Class 150.
5. Gate valves, lead free, press ends - bronze.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Gate valves, lead free, flanged ends - iron, NRS, Class 125.
2. Gate valves, lead free, flanged ends - iron, OS&Y, Class 125.
3. Gate valves, lead free, flanged ends - iron, NRS, Class 250.
4. Gate valves, lead free, flanged ends - iron, OS&Y, Class 250.

C. For CPVC Pipe:

1. NPS 2 (DN 50) and Smaller: [Union][Non-union] gate valve.
2. NPS 4 (DN 100) and Smaller: [Union][Non-union] gate valve.

D. For PVC Pipe:

1. NPS 2 (DN 50) and Smaller: [Union][Non-union] gate valve.
2. NPS 4 (DN 100) and Smaller: [Union][Non-union] gate valve.

END OF SECTION 220523

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SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers - metal, trapeze type.
2. Pipe hangers - FRP.
3. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220500 "Common Work Results for Plumbing" for pipe guides and anchors.
3. [**Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"**][**Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment"**] for vibration isolation devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:[**Signed and sealed by a qualified professional engineer.**] Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal strut support systems.
3. Rooftop-mounted strut support systems.
4. FRP strut support systems.
5. Pipe stands.
6. Equipment supports.

C. Delegated Design Submittals: For [**trapeze hangers**][**and**][**strut support systems**] indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication/assembly and design calculations for [**trapeze hangers**][**strut support systems**].
2. Detail fabrication/assembly and design calculations for each type of strut support system, by the manufacturer's technical representative.

D. Sustainable Design Submittals:

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1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design [**trapeze hangers**][**, strut support systems,**][**and**] equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment are to withstand the effects of gravity loads and stresses within limits and under conditions indicated in accordance with [**ASCE/SEI 7**]<**Insert requirement**>.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment[**and obtain approval from authorities having jurisdiction**].

2.2 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000 psi, 28-day compressive strength.

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PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination is to include weight of supported components plus [200 lb]<**Insert value**>.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

B. Install lateral bracing with pipe hangers and supports to prevent swaying.

C. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [NPS 2-1/2]<**Insert pipe size**> and larger[**and at changes in direction of piping**]. Coordinate location of concrete inserts before concrete is placed.

D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

F. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

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3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields are to span an arc of 180 degrees.

    a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
    b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

G. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

H. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate in accordance with ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel in accordance with AWS D1.1/D1.1M.

I. FRP Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

J. Strut System Installation: [**Metal, rod type**][**Metal, cable type**][**FRP**]; arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.

K. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

L. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick after concrete is placed and cured. Use installers that are licensed by powder-actuated tool manufacturer.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners in accordance with manufacturer's written

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instructions.
3. Install lag screw wood fasteners in accordance with manufacturer's written instructions.
4. Install fasteners in accordance with manufacturer's written instructions.

M. Pipe Stand Installation:

1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

N. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

O. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

P. Equipment Support Installation:

1. Fabricate from welded-structural-steel shapes.
2. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
3. Grouting: Place grout under supports for floor-mounted equipment, and make bearing surface smooth.
4. Provide lateral bracing, to prevent swaying.

3.3 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel [**pipe hangers and supports**][**metal trapeze pipe hangers**][**and**][**metal framing systems**] and attachments for general service applications.

F. Use [**stainless steel pipe hangers**][**FRP pipe hangers**][**and**][**FRP strut systems**] and [**stainless steel**][**or**][**corrosion-resistant**] attachments for hostile environment applications.

G. Use copper-plated pipe hangers and [**copper**][**or**][**stainless steel**] attachments for

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copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.

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19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of

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steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

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a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use [powder-actuated fasteners][or][mechanical-expansion anchors] instead of building attachments where required in concrete construction.

R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

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SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities" for labeling requirements, complying with NFPA 99, for medical, compressed-air system piping and associated components in healthcare facilities.
2. Section 226213 "Vacuum Piping for Laboratory and Healthcare Facilities" for labeling requirements, complying with NFPA 99, for medical surgical, healthcare laboratory, and dental vacuum system piping, waste anesthetic gas and oral evacuation system piping, and associated components in healthcare facilities.
3. Section 226313 "Gas Piping for Laboratory and Healthcare Facilities" for labeling requirements, complying with NFPA 99, for medical carbon dioxide, laboratory carbon dioxide, medical helium, laboratory helium, medical nitrogen, laboratory nitrogen, medical nitrous oxide, laboratory nitrous oxide, medical oxygen, and laboratory oxygen.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

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C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

END OF SECTION 220553

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SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Domestic chilled-water piping for drinking fountains.
5. Sanitary waste piping exposed to freezing conditions.
6. Storm-water piping exposed to freezing conditions.
7. Roof drains and rainwater leaders.
8. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation" for equipment insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Sustainable Design Submittals:

1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
2. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample,

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describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

    a. One 10-foot section of NPS 2 straight pipe.
    b. One each of a 90-degree threaded, welded, and flanged elbow.
    c. One each of a threaded, welded, and flanged tee fitting.
    d. One NPS 2 or smaller valve and one NPS 2-1/2 or larger valve.
    e. Four support hangers, including hanger shield and insert.
    f. One threaded strainer and one flanged strainer with removable portion of insulation.
    g. One threaded reducer and one welded reducer.
    h. One pressure temperature tap.
    i. One mechanical coupling.
    j. One union.
    k. <**Insert mockup**>

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect [**seven**]<**Insert number**> days in advance of dates and times when mockups will be constructed.

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4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. All Insulation Installed Indoors; Outdoors-Installed Insulation in Contact with Airstream: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
3. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

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D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents[, **unless otherwise approved by the engineer-of-record**].

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.

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5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least [4 inches]<**Insert value**> beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.2 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using [**preformed fitting insulation**][**or**][**mitered or routed fittings**] made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with [**preformed fitting insulation**][**or**][**sectional pipe insulation**] of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using [**preformed fitting insulation**][**or**][**sectional pipe insulation**] of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using [**preformed fitting insulation**][**or**][**sectional pipe insulation**] of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular

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surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation conforms to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

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3.3 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.4 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

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1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.5 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

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3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.

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2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive[**, or via self-seal mechanism**] to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

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D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections[**with the assistance of a factory-authorized service representative**].

E. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to [**three**]<**Insert number**> locations of straight pipe, [**three**]<**Insert number**> locations of threaded fittings, [**three**]<**Insert number**> locations of welded fittings, [**two**]<**Insert number**> locations of threaded strainers, [**two**]<**Insert number**> locations of welded strainers, [**three**]<**Insert number**> locations of threaded valves, and [**three**]<**Insert number**> locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

F. All insulation applications will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

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3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [1/2 inch][3/4 inch][1 inch]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1/2 inch][1 inch]<**Insert dimension**> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1/2 inch][1 inch]<**Insert dimension**> thick.
e. Phenolic: [1 inch]<**Insert dimension**> thick.
f. Polyolefin: [1/2 inch][3/4 inch][1 inch]<**Insert dimension**> thick.

2. [NPS 1-1/4]<**Insert pipe size**> and Larger: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<**Insert dimension**> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<**Insert dimension**> thick.
e. Phenolic: [1 inch]<**Insert dimension**> thick.
f. Polyolefin: [1 inch]<**Insert dimension**> thick.

B. Domestic Hot and Recirculated Hot Water:

1. [NPS 1-1/4]<**Insert pipe size**> and Smaller: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [3/4 inch][1 inch]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1/2 inch][1 inch]<**Insert dimension**> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1/2 inch][1 inch]<**Insert dimension**> thick.
e. Phenolic: [1 inch]<**Insert dimension**> thick.
f. Polyolefin: [3/4 inch][1 inch]<**Insert dimension**> thick.

2. [NPS 1-1/2]<**Insert pipe size**> and Larger: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<**Insert dimension**> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<**Insert dimension**> thick.
e. Phenolic: [1 inch]<**Insert dimension**> thick.
f. Polyolefin: [1 inch]<**Insert dimension**> thick.

C. Domestic Chilled Water (Potable):

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1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
    b. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
    c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<**Insert dimension**> thick.
    d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<**Insert dimension**> thick.
    e. Phenolic: [1 inch]<**Insert dimension**> thick.
    f. Polyolefin: [1 inch]<**Insert dimension**> thick.

D. Stormwater and Overflow:

1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
    b. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
    c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<**Insert dimension**> thick.
    d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<**Insert dimension**> thick.
    e. Phenolic: [1 inch]<**Insert dimension**> thick.
    f. Polyolefin: [1 inch]<**Insert dimension**> thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
    b. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
    c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<**Insert dimension**> thick.
    d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<**Insert dimension**> thick.
    e. Phenolic: [1 inch]<**Insert dimension**> thick.
    f. Polyolefin: [1 inch]<**Insert dimension**> thick.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Flexible Elastomeric: [1/2 inch][3/4 inch][1 inch]<**Insert dimension**> thick.
    b. Glass-Fiber, Preformed Pipe Insulation, Type I: [1/2 inch][1 inch]<**Insert dimension**> thick.
    c. Mineral Wool, Preformed Pipe Insulation, Type II: [1/2 inch][1 inch]<**Insert dimension**> thick.
    d. Polyolefin: [1/2 inch][3/4 inch][1 inch]<**Insert dimension**> thick.

G. Sanitary Waste Piping Where Heat Tracing Is Installed:

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1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Cellular Glass: [2 inches]<**Insert dimension**> thick.
    b. Glass-Fiber, Preformed Pipe Insulation, Type I: [1-1/2 inches]<**Insert dimension**> thick.
    c. Mineral Wool, Preformed Pipe Insulation, Type II: [1-1/2 inches]<**Insert dimension**> thick.
    d. Phenolic: [1-1/2 inches]<**Insert dimension**> thick.

H. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
    b. Flexible Elastomeric: [3/4 inch][1 inch]<**Insert dimension**> thick.
    c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1/2 inch][1 inch]<**Insert dimension**> thick.
    d. Mineral Wool, Preformed Pipe Insulation, Type II: [1/2 inch][1 inch]<**Insert dimension**> thick.
    e. Phenolic: [1 inch]<**Insert dimension**> thick.
    f. Polyolefin: [3/4 inch][1 inch]<**Insert dimension**> thick.

I. Hot Service Drains:

1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
    b. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<**Insert dimension**> thick.
    c. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<**Insert dimension**> thick.

J. Hot Service Vents:

1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
    b. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<**Insert dimension**> thick.
    c. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<**Insert dimension**> thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation is[**one of**] the following:

    a. Cellular Glass: [2 inches]<**Insert dimension**> thick.

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b. Flexible Elastomeric: [2 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.
e. Phenolic: [2 inches]<Insert dimension> thick.
f. Polyolefin: [2 inches]<Insert dimension> thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [2 inches]<Insert dimension> thick.
b. Flexible Elastomeric: [2 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.
e. Phenolic: [2 inches]<Insert dimension> thick.
f. Polyolefin: [2 inches]<Insert dimension> thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [2 inches]<Insert dimension> thick.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
c. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.
d. Phenolic: [2 inches]<Insert dimension> thick.

D. Hot Service Drains:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [1-1/2 inches]<Insert dimension> thick.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<Insert dimension> thick.
c. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<Insert dimension> thick.

E. Hot Service Vents:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [1-1/2 inches]<Insert dimension> thick.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<Insert dimension> thick.
c. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<Insert dimension> thick.

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3.12 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, [2 inches]<**Insert dimension**> thick.

B. Chilled Water, All Sizes: Cellular glass, [2 inches]<**Insert dimension**> thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. [**PVC**][**PVC, Color-Coded by System**]: [20 mils][30 mils] thick.
3. Aluminum, [**Smooth**][**Corrugated**][**Stucco Embossed**]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [**Smooth**][**Corrugated**][**Stucco Embossed**]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [**Type 304**][**or**][**Type 316**], [**Smooth No. 2B Finish**][**Corrugated**][**Stucco Embossed**]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <**Insert jacket type**>.

D. Piping, Exposed:

1. None.
2. [**PVC**][**PVC, Color-Coded by System**]: [20 mils][30 mils] thick.
3. Aluminum, [**Smooth**][**Corrugated**][**Stucco Embossed**]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [**Smooth**][**Corrugated**][**Stucco Embossed**]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [**Type 304**][**or**][**Type 316**], [**Smooth No. 2B Finish**][**Corrugated**][**Stucco Embossed**]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <**Insert jacket type**>.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

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1. None.
2. [PVC][PVC, Color-Coded by System]: [20 mils][30 mils] thick.
3. Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [Type 304][or][Type 316], [Smooth No. 2B Finish][Corrugated][Stucco Embossed]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <Insert jacket type>.

D. Piping, Exposed:

1. PVC: [20 mils][30 mils][40 mils] thick.
2. [Painted]Aluminum, [Smooth][Corrugated][Stucco Embossed][with Z-Shaped Locking Seam]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
3. Stainless Steel, [Type 304][or][Type 316], [Smooth No. 2B Finish][Corrugated][Stucco Embossed][with Z-Shaped Locking Seam]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
4. <Insert jacket type>.

END OF SECTION 220719

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SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping joining materials - domestic water.
2. Encasement for piping.

B. Related Requirements:

1. Section 331415 "Site Water Distribution Piping" for water-service piping[**and water meters**] outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper tube and fittings - domestic water.
2. Ductile-iron pipe and fittings - domestic water.
3. Galvanized-steel pipe and fittings - domestic water.
4. Stainless steel piping and fittings - domestic water.
5. CPVC piping - domestic water.
6. PEX tube and fittings - domestic water.
7. PEX-AL-PEX tube and fittings - domestic water.
8. PEX-AL-HDPE tube and fittings - domestic water.
9. PVC pipe and fittings - domestic water.
10. Polypropylene (PP-R and PP-RCT) pipe and fittings - domestic water.
11. Piping joining materials - domestic water.
12. Encasement for piping.
13. Transition fittings - domestic water.
14. Dielectric fittings - domestic water.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Environmental Product Declaration: For each product.
4. Third-Party Certifications: For each product.
5. Third-Party Certified Life Cycle Assessment: For each product.

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1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installers of pressure-sealed joints are to be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service in accordance with requirements indicated:

1. Notify [Architect][Construction Manager][Owner] no fewer than [two]<Insert number> days in advance of proposed interruption of water service.
2. Do not interrupt water service without [Architect's][Construction Manager's][Owner's] written permission.

1.6 WARRANTY

A. Polypropylene (PP-R and PP-RCT) Pipe and Fittings Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R and PP-RCT pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of piping system due to defects in materials or manufacturing.
2. Warranty is to be in effect only upon submission by Contractor to manufacturer of valid pressure/leak documentation indicating that the system was tested and passed manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water piping, tubing, fittings, joints, and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking

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Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PIPING MATERIALS

A. Potable-water piping and components are to comply with NSF 14, NSF 61, and NSF 372.[**Include marking "NSF-pw" on piping.**]

2.3 PIPING JOINING MATERIALS - DOMESTIC WATER

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F493.

1. Solvent cement shall have a VOC content of 490 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

G. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.

1. Solvent cement shall have a VOC content of 510 g/L or less.
2. Adhesive primer shall have a VOC content of 550 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
4. Adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and

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Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller is to be the following:

1. Annealed-temper copper tube, [ASTM B88, Type K][ASTM B88, Type L]; [**wrought-copper, solder-joint fittings; and brazed**][**copper pressure-seal fittings; and pressure-sealed**] joints.
2. PVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
3. Polypropylene (PP-R and PP-RCT), [**SDR 7.4**][**SDR 11**] pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) and larger is to be the following:

1. Annealed-temper copper tube, [ASTM B88, Type K][ASTM B88, Type L]; wrought-copper, solder-joint fittings; and brazed joints.
2. Mechanical-joint, ductile-iron pipe; [**standard-**][**or**][**compact-**]pattern, mechanical-joint fittings; and mechanical joints.
3. Push-on joint, ductile-iron pipe; [**standard-**][**or**][**compact-**]pattern, push-on joint fittings; and gasketed joints.
4. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
5. PVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
6. Polypropylene (PP-R and PP-RCT), [**SDR 7.4**][**SDR 11**] pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

F. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12 (DN 150 to DN 300) is to be the following:

1. Mechanical-joint, ductile-iron pipe; [**standard-**][**or**][**compact-**]pattern, mechanical-

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joint fittings; and mechanical joints.
2. Push-on joint, ductile-iron pipe; [**standard-**][**or**][**compact-**]pattern, push-on joint fittings; and gasketed joints.
3. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

G. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller is to be the following:

1. [**Drawn-temper**][**or**][**annealed-temper**] copper tube, ASTM B88, Type L; [**wrought-copper, solder-joint fittings; and brazed**][**copper pressure-seal-joint fittings; and pressure-sealed**] joints.
2. PVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
3. Polypropylene (PP-R and PP-RCT), [**SDR 7.4**][**SDR 11**] pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

H. Aboveground domestic water piping, NPS 2 (DN 50) and smaller is to be the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Drawn-temper copper tube, [ASTM B88, Type L][ASTM B88, Type M]; [**cast-**][**or**][**wrought-**]copper, solder-joint fittings; and [**brazed**][**soldered**] joints.
3. Drawn-temper copper tube, [ASTM B88, Type L][ASTM B88, Type M]; copper pressure-seal-joint fittings; and pressure-sealed joints.
4. Drawn-temper copper tube, [ASTM B88, Type L][ASTM B88, Type M]; copper push-on joint fittings; and push-on joints.
5. Stainless steel, [**Schedule 5**][**or**][**Schedule 10**] pipe; pressure-seal-joint fittings; and pressure-sealed joints.
6. CPVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
7. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
8. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.[NPS 1-1/2 **and** NPS 2 **CPVC pipe with CPVC socket fittings may be used instead of tubing.**]
9. PEX tube, NPS 1 and smaller.

    a. Fittings for PEX tube:

        1) ASTM F1807, metal insert and copper crimp rings.
        2) ASTM F1960, cold expansion fittings and reinforcing rings.
        3) ASSE 1061, push-fit fittings.

10. PEX-AL-PEX tube, NPS 1 and smaller; fittings for PEX-AL-PEX tube; and crimped joints.
11. PVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
12. Polypropylene (PP-R and PP-RCT), [**SDR 7.4**][**SDR 11**] pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

I. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) is to be the following:

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1. Drawn-temper copper tube, [ASTM B88, Type L][ASTM B88, Type M]; [**cast-**][**or**][**wrought-**]copper, solder-joint fittings; and [**brazed**][**soldered**] joints.
2. Drawn-temper copper tube, [ASTM B88, Type L][ASTM B88, Type M]; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Drawn-temper copper tube, [ASTM B88, Type L][ASTM B88, Type M]; grooved-joint, copper-tube appurtenances; and grooved joints.
4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
6. Stainless steel, [**Schedule 5**][**Schedule 10**][**Schedule 40**] pipe; grooved-joint fittings, and grooved joints.
7. CPVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
8. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
9. PVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
10. Polypropylene (PP-R and PP-RCT), [**SDR 7.4**][**SDR 11**] pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

J. Aboveground domestic water piping, NPS 5 to NPS 8 (DN 125 to DN 200), is to be the following:

1. Drawn-temper copper tube, [ASTM B88, Type L][ASTM B88, Type M]; [**cast-**][**or**][**wrought-**]copper, solder-joint fittings; and [**brazed**][**soldered**] joints.
2. Drawn-temper copper tube, [ASTM B88, Type L][ASTM B88, Type M]; grooved-joint, copper-tube appurtenances; and grooved joints.
3. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
4. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
5. Stainless steel [**Schedule 5**][**Schedule 10**][**Schedule 40**] pipe, grooved-joint fittings, and grooved joints.
6. CPVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
7. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
8. PVC, [**Schedule 40**][**Schedule 80**]; socket fittings; and solvent-cemented joints.
9. Polypropylene (PP-R and PP-RCT) [**SDR 7.4**][**SDR 11**] pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

K. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12 (DN 150 to DN 300) is to be the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
4. Stainless steel [**Schedule 5**][**Schedule 10**][**Schedule 40**] pipe, grooved-joint fittings, and grooved joints.

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3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab in accordance with CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints in accordance with AWWA C600 and AWWA M41.

D. Install underground [**copper tube**][**and**][**ductile-iron pipe**] in PE encasement in accordance with ASTM A674 or AWWA C105/A21.5.

E. Install valves in accordance with Section 220523 "General-Duty Valves for Plumbing Piping."

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level [**with 0.25 percent slope downward toward drain**][**without pitch**] and plumb.

H. Rough-in domestic water piping for water-meter installation in accordance with utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

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P. Install fittings for changes in direction and branch connections.

Q. Install PEX tube with loop at each change of direction of more than 90 degrees.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220500 "Common Work Results for Plumbing."

T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123.21 "Inline, Domestic Water Pumps."

U. Install thermometers on[inlet and] outlet piping from each water heater. Comply with requirements for thermometers in Section 220500 "Common Work Results for Plumbing."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.3 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition [fittings][or][unions].

3.4 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric [couplings][couplings or nipples][nipples][unions].

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C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric [**flanges**][**flange kits**][**nipples**].

D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for [**copper**][**ductile iron**][**galvanized steel**][**and**][**stainless steel**][**tube**][**and**][**pipe**], with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install vinyl-coated hangers for [**CPVC**][**PVC**][**and**][**PP-R/PP-RCT**] pipe, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Install vinyl-coated hangers for PEX tube, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support horizontal piping within [12 inches]<**Insert dimension**> of each fitting.

G. Support vertical runs of [**copper**][**ductile iron**][**galvanized steel**][**and**][**stainless steel**][**tube**][**and**][**pipe**] to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

H. Support vertical runs of [**CPVC**][**PVC**][**and**][**PP-R/PP-RCT**] pipe to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

I. Support vertical runs of PEX tube to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been

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inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after installation and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Hydrostatic testing and documentation of test results for polypropylene (PP-R and PP-RCT) pipe to be in accordance with manufacturer's written instructions and submitted to manufacturer upon successful completion per warranty requirements.
f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
g. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Drain valves.

B. Related Requirements:

1. Section 220500 "Common Work Results for Plumbing."
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
4. Section 224300 "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
5. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
6. Section 224700 "Drinking Fountains and Water Coolers."
7. Section 230923.18 "Leak Detection Instruments" for leak detection devices related to HVAC applications.
8. Section 331415 "Site Water Distribution Piping" for fire water-service backflow prevention devices.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

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PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: [125 psig]<**Insert value**> unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves[**and bypass with memory-stop balancing valve**]. Install pressure gauges on inlet and outlet.

C. Water Control Valves: Install with inlet and outlet shutoff valves[**and bypass with globe valve**]. Install pressure gauges on inlet and outlet.

D. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.

E. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

F. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves

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on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Y-Pattern Strainers: For water, install on supply side of each [**control valve**][**water pressure-reducing valve**][**solenoid valve**][**and**][**pump**].

H. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install **1-1/2-by-3-1/2-inch** fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

I. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install **1-1/2-by-3-1/2-inch** fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

J. Ground Hydrants: Install with [**1 cu. yd.**]<**Insert dimension**> of crushed gravel around drain hole. Set ground hydrants with box flush with grade.

K. Nonfreeze, Draining-Type Post Hydrants: Install with [**1 cu. yd.**]<**Insert dimension**> of crushed gravel around drain hole. Set post hydrants in concrete paving or in [**1 cu. ft.**]<**Insert dimension**> of concrete block at grade.

L. Nonfreeze, Nondraining-Type Post Hydrants: Set in concrete or pavement.

M. Nonfreeze, Sanitary Yard Hydrants: Set with riser pipe in concrete or pavement. Do not encase canister in concrete.

N. Nonfreeze, Draining-Type Roof Hydrants: Install with drain connection piped to nearest floor drain or to the exterior.

O. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

P. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

Q. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

R. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

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3.2 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner will engage**][**Engage**] a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections[**with the assistance of a factory-authorized service representative**].

1. Test each [**pressure vacuum breaker**][**reduced-pressure-principle backflow preventer**][**double-check, backflow-prevention assembly**][**and**][**double-check, detector-assembly backflow preventer**]<**Insert type**> according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 221119

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SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Specialty pipe fittings.
2. Encasement for underground metal piping.

B. Related Requirements:

1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
2. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.
3. Section 333115 "Site Sanitary Sewerage Piping" for sanitary sewerage piping and structures outside the building.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.

C. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

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1.4 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify [**Architect**][**Construction Manager**][**Owner**] no fewer than [**two**]<**Insert number**> days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without [**Architect's**][**Construction Manager's**][**Owner's**] written permission.

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: [10 ft. head of water]<**Insert pressure**>.
2. Waste, Force-Main Piping: [50 psig][100 psig][150 psig]<**Insert pressure**>.

B. Seismic Performance: Soil, waste, and vent piping and support and installation to withstand the effects of earthquake motions determined in accordance with [**ASCE/SEI 7**]<**Insert requirement**>. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment":

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."
2. Component Importance Factor: [**1.5**][**1.0**].

C. <**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

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2.3 SPECIALTY PIPE FITTINGS

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in [Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"][Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment"].

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

a. Straight tees, elbows, and crosses may be used on vent lines.

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3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

L. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; [1][2]<Insert number> percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: [Two]<Insert number> percent downward in direction of flow.
3. Vent Piping: [One]<Insert number> percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping in accordance with ASTM A674 or AWWA C105/A 21.5.

O. Install steel piping in accordance with applicable plumbing code.

P. Install stainless steel piping in accordance with ASME A112.3.1 and applicable plumbing code.

Q. Install aboveground copper tubing in accordance with CDA's "Copper Tube Handbook."

R. Install aboveground ABS piping in accordance with ASTM D2661.

S. Install aboveground PVC piping in accordance with ASTM D2665.

T. Install underground [ABS][and][PVC] piping in accordance with ASTM D2321.

U. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation

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instructions.

3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

V. Install underground, ductile-iron, force-main piping according to AWWA C600.

1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.

W. Install underground, copper, force-main tubing in accordance with CDA's "Copper Tube Handbook."

1. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.

X. Install force mains at elevations indicated.

Y. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

Z. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

AA. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

BB. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220500 "Common

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Work Results for Plumbing."

CC. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.2 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: [**Unshielded**][**Shielded**], nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric [**nipples**][**unions**].
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric [**flanges**][**flange kits**][**nipples**].
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.3 INSTALLATION OF VALVES

A. General valve installation requirements for general-duty valve installation are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install [**gate**][**full-port ball**] valve for piping NPS 2 and smaller.
3. Install [**gate**]<**Insert type**> valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves.[**Use normally closed type unless otherwise indicated.**]
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.

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3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in [**Section 220529 "Hangers and Supports for Plumbing Piping and Equipment"**][**Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment"**].

1. Install [**carbon-steel**]<**Insert material**> pipe hangers for horizontal piping in noncorrosive environments.
2. Install [**stainless steel**][**fiberglass**] pipe hangers for horizontal piping in corrosive environments.
3. Install [**carbon-steel**]<**Insert material**> pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42 clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Ft. (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52 spring hangers.

C. Install hangers for [**cast-iron**][**steel**][**stainless steel**][**and**][**copper**] soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for [**ABS**][**and**][**PVC**] piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping and tubing within 12 inches of each fitting[**, valve,**] and coupling.

F. Support vertical runs of [**cast-iron**][**steel**][**stainless steel**][**and**][**copper**] soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

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G. Support vertical runs of [ABS][and][PVC] piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg.

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b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
c. Air pressure must remain constant without introducing additional air throughout period of inspection.
d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

a. Isolate test source and allow to stand for four hours.
b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.6 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller are to be the following:

1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings[**and hubless, single-stack aerator fittings**]; [**CISPI**][**heavy-duty**] hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless steel pipe and fittings, sealing rings, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
6. [**Solid-wall**][**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger are to be the following:

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1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings [**and hubless, single-stack aerator fittings**]; [**CISPI**][**heavy-duty**] hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless steel pipe and fittings, sealing rings, and gasketed joints.
5. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 (DN 100) is to be the following:

1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; [**CISPI**][**heavy-duty**] hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless steel pipe and fittings gaskets, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type M; copper pressure fittings; and soldered joints.

6. [**Solid-wall**][**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 (DN 125) and larger is to be the following:

1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; [**CISPI**][**heavy-duty**] hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller are to be the following:

1. [**Extra-heavy**][**Service**] cast-iron soil piping; [**gaskets; and gasketed**][**caulking materials; and caulked**] joints.
2. Hubless, cast-iron soil pipe and fittings; [**CISPI**][**heavy-duty**][**cast-iron**] hubless-piping couplings; and coupled joints.
3. Stainless steel pipe and fittings, gaskets, and gasketed joints.
4. [**Solid-wall**][**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.

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5. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 (DN 125) and larger are to be the following:

1. [**Extra-heavy**][**Service**], cast-iron soil piping; [**gaskets; and gasketed**][**caulking materials; and caulked**] joints.
2. Hubless, cast-iron soil pipe and fittings; [**CISPI**][**heavy-duty**][**cast-iron**] hubless-piping couplings; coupled joints.
3. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 (DN 40 and DN 50) are to be the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 (DN 65 to DN 150) are to be the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.
3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

J. Underground sanitary-sewage force mains NPS 4 (DN 100) and smaller are to be the following:

1. [**Hard**][**Soft**] copper tube, Type L; [**wrought-**]copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

K. Underground sanitary-sewage force mains NPS 5 (DN 125) and larger are to be the following:

1. Hard copper tube, Type L; [**wrought-**]copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Pressure transition couplings if dissimilar pipe materials.

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END OF SECTION 221316

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SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
2. Section 077200 "Roof Accessories" for preformed flashings.
3. Section 078413 "Penetration Firestopping" for through-penetration firestop assemblies.
4. Section 221323 "Sanitary Waste Interceptors" for metal and concrete interceptors outside the building, grease interceptors, grease-removal devices, oil interceptors, and solids interceptors.
5. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
6. Section 224300 "Healthcare Plumbing Fixtures" for plaster sink interceptors.
7. Section 334200 "Stormwater Conveyance" for storm drainage piping and piping specialties outside the building.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show fabrication and installation details for frost-resistant vent terminals.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

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PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install fixture air-admittance valves on fixture drain piping.

F. Install stack air-admittance valves at top of stack vent and vent stack piping.

G. Install air-admittance-valve wall boxes recessed in wall.

H. Assemble open drain fittings and install with top of hub [1 inch][2 inches]<**Insert dimension**> above floor.

I. Install deep-seal traps on floor drains and other waste outlets, if indicated.

J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

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1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

L. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

M. Install vent caps on each vent pipe passing through roof.

N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

P. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

Q. Install wood-blocking reinforcement for wall-mounting-type specialties.

R. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

END OF SECTION 221319

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SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, direct-vent, gas-fired, storage, domestic-water heater.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.[**Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.**]

B. Sustainable Design Submittals:

1. Product Data: For energy efficiency.

C. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.

B. Seismic Qualification Data: Certificates, for fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of [**commercial, gas-fired,**][**gas-fired, tankless,**][**residential, gas-fired,**][**commercial, oil-fired,**][**residential, oil-fired,**][**and**][**commercial, gas- and oil-fired,**] domestic-water heater.

D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

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E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: [Three][Five]<Insert number> years.
2) Controls and Other Components: [One][Two]<Insert number> year(s).

b. Commercial, Finned-Tube, Gas-Fired, Domestic-Water Heaters:

1) Heat Exchanger: [Three][Five]<Insert number> years.
2) Controls and Other Components: [One][Two]<Insert number> year(s).
3) Separate Hot-Water Storage Tanks: [Three][Five]<Insert number> years.

c. Gas-Fired, Tankless, Domestic-Water Heaters:

1) Heat Exchanger: [Five]<Insert number> years.
2) Controls and Other Components: [Three]<Insert number> years.

d. Residential, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: [Five][Six]<Insert number> years.
2) Controls and Other Components: [Two][Three]<Insert number>

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years.

e. Commercial, Oil-Fired, Domestic-Water Heaters:

1) Storage Tank: [Three][Five]<Insert number> years.
2) Burner: [One][Two]<Insert number> year(s).
3) Controls and Other Components: [One][Two][Three]<Insert number> year(s).

f. Residential, Oil-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: [Five][Six]<Insert number> years.
2) Burner: [One][Two]<Insert number> year(s).
3) Controls and Other Components: [Two][Three]<Insert number> years.

g. Commercial, Gas- and Oil-Fired, Domestic-Water Heaters:

1) Storage Tank: [Three][Five]<Insert number> years.
2) Burner: [One][Two]<Insert number> year(s).
3) Controls and Other Components: [Two][Three]<Insert number> years.

h. Expansion Tanks: [Five]<Insert number> years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with [ASCE/SEI 7]<Insert requirement>.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[and the unit will be fully operational after the seismic event]."
2. Component Importance Factor: [1.5][1.0].
3. <Insert requirements for Component Amplification Factor and Component Response Modification Factor>.

C. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.

1. Comply with efficiency requirements in ASHRAE 189.1, which supersede requirements in ASHRAE/IESNA 90.1.

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D. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

E. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters[**and storage tanks**] specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test[**commercial**] domestic-water heaters[**and storage tanks**] to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC-WATER HEATER

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.

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8. Anchor domestic-water heaters to substrate.

B. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on [**floor**][**water-heater stand on floor**][**domestic-water heater mounting bracket**].

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters[**at least 18 inches above floor**] on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

D. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

E. Install gas-fired, domestic-water heaters in accordance with NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in [**Section 231123 "Facility Natural-Gas Piping."**][**Section 231126 "Facility Liquefied-Petroleum Gas Piping."**]

F. Install oil-fired, domestic-water heaters in accordance with NFPA 31.

1. Install shutoff valves on fuel-oil supply piping to oil-fired water-heater burners without shutoff valves. Comply with requirements for shutoff valves specified in Section 231113 "Facility Fuel-Oil Piping."

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G. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" and Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

H. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

I. Install [combination temperature-and-]pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

J. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

K. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."

L. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."

M. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

N. Fill domestic-water heaters with water.

O. Charge domestic-water expansion tanks with air to required system pressure.

P. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 FIELD QUALITY CONTROL

A. Testing Agency:

1. Owner will engage a qualified testing agency to perform tests and inspections.
2. Engage a qualified testing agency to perform tests and inspections.

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B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections[**with the assistance of a factory-authorized service representative**].

D. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.3 DEMONSTRATION

A. [**Engage a factory-authorized service representative to train**][**Train**] Owner's maintenance personnel to adjust, operate, and maintain [**commercial, gas-fired, storage,**][**gas-fired, tankless**][**commercial, oil-fired,**][**commercial, gas- and oil-fired,**] domestic-water heaters. Training shall be a minimum of [**one**][**two**]<**Insert duration**> hour(s).

END OF SECTION 223400

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SECTION 224100 - RESIDENTIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supply fittings.
2. Waste fittings.
3. Grout.

B. Related Requirements:

1. Section 224200 "Commercial Plumbing Fixtures."
2. Section 224300 "Healthcare Plumbing Fixtures."
3. Section 224500 "Emergency Plumbing Fixtures."
4. Section 224600 "Security Plumbing Fixtures."
5. Section 224700 "Drinking Fountains and Water Coolers."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For water consumption.
2. Plumbing Fixtures: Provide the following:

a. Manufacturer cut sheet indicating water consumption.
b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

B. Sample Warranty: For special warranty.

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1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of [**whirlpool baths**][**and**][**walk-in baths**].

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of [**walk-in baths**][**and**][**whirlpool baths**] that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Residential Applications of Shells: [**Five**][**20**][**30**]<**Insert number**> years from date of Substantial Completion.
3. Warranty Period for Residential Applications of Pumps and Blowers: [**Five**][**20**]<**Insert number**> years from date of Substantial Completion.
4. Warranty Period for Residential Applications of Electronic Controls: [**Five**]<**Insert number**> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Domestic water faucets intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

PART 3 - EXECUTION

3.1 INSTALLATION OF RESIDENTIAL PLUMBING FIXTURES

A. Install plumbing fixtures level and plumb in accordance with roughing-in drawings.

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B. Install floor-mounted water closets on closet flange attachments to drainage piping.

C. Install counter-mounting fixtures in and attached to casework.

D. Install pedestal lavatories on pedestals and secured to wood blocking in wall.

E. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Use ball or gate valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

F. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

G. Install toilet seats on water closets.

H. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

I. Install shower flow-control fittings with specified maximum flow rates in shower arms.

J. Install traps on fixture outlets.

1. Omit trap on fixtures with integral traps.
2. Omit trap on indirect wastes unless otherwise indicated.

K. Install disposer in outlet of each sink indicated to have a disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

L. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.

M. Set [bathtubs][baths][and][shower receptors] in leveling bed of cement grout.

N. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible [lavatories][and][sinks]. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

O. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

P. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

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SECTION 230130.52 - EXISTING HVAC AIR DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning existing HVAC air-distribution equipment, ducts, plenums, and system components.

B. Related Requirements:

1. Section 233113 "Metal Ducts" for cleaning newly installed metal ducts.
2. Section 233116 "Nonmetal Ducts" for cleaning newly installed nonmetal ducts.
3. Section 230593 "Testing, Adjusting, Balancing for HVAC" for system flow documentation before cleaning and balancing and following cleaning and restoration.
4. Section 233300 "Air Duct Accessories" for restoration of opened ducts and plenums with access doors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Cleaning agents
2. Antimicrobial surface treatments[**("sealant" for sustainable design submittal purposes)**].

B. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, indicating VOC content.
2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For an ASCS.
2. For an IEP.
3. For a CMR and a CMRS.

B. Field Quality-Control Reports:

1. Project's existing conditions.
2. Evaluations and recommendations, including cleanliness verification.
3. Strategies and procedures plan.

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1.4 CLOSEOUT SUBMITTALS

A. Post-Project report.

1.5 QUALITY ASSURANCE

A. ASCS Qualifications: [**A certified member of NADCA**]<**Insert objective qualifications**>.

1. Certification: Employ [**an ASCS certified by NADCA on a full-time basis**]<**Insert objective qualifications**>.
2. Supervisor Qualifications: Certified [**as an ASCS by NADCA**]<**Insert objective qualifications**>.

B. IEP Qualifications: [**CMI who is certified by ACAC and accredited by CESB**][**CMC who is certified by ACAC and accredited by CESB**].

C. CMR Qualifications: Certified by ACAC and accredited by CESB.

D. CMRS Qualifications: Certified by ACAC and accredited by CESB.

E. <**Insert objective qualifications for microbial remediation specialist**>.

F. UL Compliance: Comply with UL 181 and UL 181A for fibrous-glass ducts.

G. Cleaning Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Review methods and procedures related to HVAC air-distribution system cleaning, including, but not limited to, review of the cleaning strategies and procedures plan.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 230130.52

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SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Motors.
2. Packed expansion joints.
3. Packless expansion joints.
4. Alignment guides and anchors.
5. Sleeves without waterstop.
6. Grout.
7. Silicone sealants.
8. Thermometers, filled system.
9. Thermometers, liquid in glass.
10. Thermometers, light activated.
11. Duct-thermometer mounting brackets.
12. Thermowells.
13. Pressure gauges, dial type.
14. Gauge attachments.
15. Flowmeters.
16. Thermal-energy meters.

B. Related Requirements:

1. Section 231123 "Facility Natural-Gas Piping" for gas meters.
2. Section 232216 "Steam and Condensate Piping Specialties" for steam and condensate meters.
3. Section 230923.13 "Energy Meters" for thermal-energy meters connecting with the DDC system.
4. Section 230923.14 "Flow Instruments" for primary flow instruments connecting with the DDC system.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product, excluding motors which are included in Part 1 of HVAC equipment Sections.

    a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
    b. Include operating characteristics and furnished accessories.

B. Delegated Design Submittals: For each anchor and alignment guide, including analysis

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data, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter.

B. Welding certificates.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of [expansion joint,][meter,][and][gauge] to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION JOINTS - GENERAL

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

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3.2 INSTALLATION OF PACKED EXPANSION JOINTS

A. Install packed expansion joints with packing suitable for fluid service.

3.3 INSTALLATION OF PACKLESS EXPANSION JOINTS

A. Install metal-bellows packless expansion joints in accordance with EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

B. Install rubber packless expansion joints in accordance with FSA-PSJ-703.

3.4 INSTALLATION OF GROOVED-JOINT EXPANSION JOINTS

A. Install grooved-joint expansion joints to grooved-end steel piping.

3.5 INSTALLATION OF ALIGNMENT GUIDES AND ANCHORS

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install [one][two] guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than [four]<Insert number> pipe diameters from expansion joint.

C. Attach guides to pipe, and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9.
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-58, Type 24; U bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
3. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

3.6 INSTALLATION OF PIPE LOOPS AND SWING CONNECTIONS

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb

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tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least [five]<Insert number> pipe fittings, including tee in main.

C. Connect risers and branch connections to terminal units with at least [four]<Insert number> pipe fittings, including tee in riser.

D. Connect mains and branch connections to terminal units with at least [four]<Insert number> pipe fittings, including tee in main.

3.7 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide [1-inch][2-inch]<Insert dimension> annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas [2 inches]<Insert dimension> above finished floor level.

3. Using [grout][or][silicone sealant], seal space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in

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Section 078413 "Penetration Firestopping."

3.8 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using [**grout**][**or**][**silicone sealant**], seal space around outside of sleeves.

3.9 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 3 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.10 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.11 INSTALLATION OF METERS AND GAUGES

A. Install thermowells with socket extending [**a minimum of 2 inches into fluid**][**one-third of**

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pipe diameter][to center of pipe] and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing, and support tubing to prevent kinks. Use minimum tubing length.

G. Install pipe-mounted thermal-energy temperature sensors in thermowells and extend wiring to indicator.

H. Install duct-thermometer-mounting brackets in walls of ducts. Attach to duct with screws.

I. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.

J. Install remote-mounted pressure gauges on panel.

K. Install valve and snubber in piping for each pressure gauge for fluids (except steam).

L. Install valve and syphon fitting in piping for each pressure gauge for steam.

M. Install test plugs in piping tees.

N. Install flow indicators in piping systems in accessible positions for easy viewing.

O. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

P. Install flowmeter elements in accessible positions in piping systems.

Q. Install wafer-orifice flowmeter elements between orifice-type pipe flanges.

R. Install all flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

S. Install permanent indicators on walls or brackets in accessible and readable positions.

T. Install connection fittings in accessible locations for attachment to portable indicators.

U. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.

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V. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Two inlets and two outlets of each chiller.
4. Inlet and outlet of each hydronic coil in air-handling units.
5. Two inlets and two outlets of each hydronic heat exchanger.
6. Inlet and outlet of each thermal-storage tank.
7. Outside-, return-, supply-, and mixed-air ducts.
8. <Insert location>.

W. Install pressure gauges in the following locations:

1. Discharge of each pressure-reducing valve.
2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
3. Suction and discharge of each pump.
4. <Insert location>.

3.12 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:

1. Perform the following tests and inspections:

a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

2. Prepare test and inspection reports.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.13 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:

a. Sleeves with waterstops.

1) Select sleeve size to allow for [1-inch]<Insert dimension> annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:

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a. Sleeves with waterstops.

1) Select sleeve size to allow for [1-inch]<Insert dimension> annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

a. [Sleeves with waterstops][or][stack-sleeve fittings].

4. Interior Walls and Partitions:

a. Sleeves without waterstops.

3.14 THERMOMETER APPLICATION

A. Thermometers at inlet and outlet of each hydronic zone are to be the following:

1. [Liquid-filled][Sealed], bimetallic-actuated type.
2. [Direct][Remote]-mounted, [metal][plastic]-case, vapor-actuated type.
3. [Compact][Industrial]-style, liquid-in-glass type.
4. [Direct][Remote]-mounted, light-activated type.
5. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

B. Thermometers at inlet and outlet of each hydronic boiler are to be the following:

1. [Liquid-filled][Sealed], bimetallic-actuated type.
2. [Direct][Remote]-mounted, [metal][plastic]-case, vapor-actuated type.
3. [Compact][Industrial]-style, liquid-in-glass type.
4. [Direct][Remote]-mounted, light-activated type.
5. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

C. Thermometers at inlets and outlets of each chiller are to be the following:

1. [Liquid-filled][Sealed], bimetallic-actuated type.
2. [Direct][Remote]-mounted, [metal][plastic]-case, vapor-actuated type.
3. [Compact][Industrial]-style, liquid-in-glass type.
4. [Direct][Remote]-mounted, light-activated type.
5. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

D. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems are to be the following:

1. [Liquid-filled][Sealed], bimetallic-actuated type.
2. [Direct][Remote]-mounted, [metal][plastic]-case, vapor-actuated type.
3. [Compact][Industrial]-style, liquid-in-glass type.
4. [Direct][Remote]-mounted, light-activated type.

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5. Test plug with [**chlorosulfonated polyethylene synthetic**][**EPDM**] self-sealing rubber inserts.

E. Thermometers at inlets and outlets of each hydronic heat exchanger are to be the following:

1. [**Liquid-filled**][**Sealed**], bimetallic-actuated type.
2. [**Direct**][**Remote**]-mounted, [**metal**][**plastic**]-case, vapor-actuated type.
3. [**Compact**][**Industrial**]-style, liquid-in-glass type.
4. [**Direct**][**Remote**]-mounted, light-activated type.
5. Test plug with [**chlorosulfonated polyethylene synthetic**][**EPDM**] self-sealing rubber inserts.

F. Thermometers at inlet and outlet of each hydronic heat-recovery unit are to be the following:

1. [**Liquid-filled**][**Sealed**], bimetallic-actuated type.
2. [**Direct**][**Remote**]-mounted, [**metal**][**plastic**]-case, vapor-actuated type.
3. [**Compact**][**Industrial**]-style, liquid-in-glass type.
4. [**Direct**][**Remote**]-mounted, light-activated type.
5. Test plug with [**chlorosulfonated polyethylene synthetic**][**EPDM**] self-sealing rubber inserts.

G. Thermometers at inlet and outlet of each thermal-storage tank are to be the following:

1. [**Liquid-filled**][**Sealed**], bimetallic-actuated type.
2. [**Direct**][**Remote**]-mounted, [**metal**][**plastic**]-case, vapor-actuated type.
3. [**Compact**][**Industrial**]-style, liquid-in-glass type.
4. [**Direct**][**Remote**]-mounted, light-activated type.
5. Test plug with [**chlorosulfonated polyethylene synthetic**][**EPDM**] self-sealing rubber inserts.

H. Thermometers at outside-, return-, supply-, and mixed-air ducts are to be the following:

1. [**Liquid-filled**][**Sealed**], bimetallic-actuated type.
2. [**Direct**][**Remote**]-mounted, [**metal**][**plastic**]-case, vapor-actuated type.
3. [**Compact**][**Industrial**]-style, liquid-in-glass type.
4. [**Direct**][**Remote**]-mounted, light-activated type.

I. Thermometer stems are to be of length to match thermowell insertion length.

3.15 THERMOMETER SCALE-RANGE APPLICATION

A. Scale Range for Chilled-Water Piping:

1. [Minus 40 to plus 160 deg F][**Minus 40 to plus 160 deg F and minus 40 to plus 100 deg C**].
2. [0 to 100 deg F][**0 to 100 deg F and minus 20 to plus 50 deg C**].
3. [0 to 150 deg F][**0 to 150 deg F and minus 20 to plus 70 deg C**].
4. [0 to 250 deg F][**0 to 250 deg F and 0 to 150 deg C**].

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B. Scale Range for Condenser-Water Piping:

1. [0 to 100 deg F][0 to 100 deg F and minus 20 to plus 50 deg C].
2. [0 to 150 deg F][0 to 150 deg F and minus 20 to plus 70 deg C].
3. [0 to 250 deg F][0 to 250 deg F and 0 to 150 deg C].
4. [20 to 240 deg F][20 to 240 deg F and 0 to 150 deg C].
5. [30 to 240 deg F][30 to 240 deg F and 0 to plus 115 deg C].

C. Scale Range for Heating, Hot-Water Piping:

1. [0 to 250 deg F][0 to 250 deg F and 0 to 150 deg C].
2. [20 to 240 deg F][20 to 240 deg F and 0 to 150 deg C] .
3. [30 to 240 deg F][30 to 240 deg F and 0 to plus 115 deg C].
4. [50 to 400 deg F][50 to 400 deg F and 0 to 200 deg C].
5. [50 to 550 deg F][50 to 550 deg F and 10 to 300 deg C].

D. Scale Range for Steam and Steam-Condensate Piping:

1. [0 to 250 deg F][0 to 250 deg F and 0 to 150 deg C].
2. [0 to 250 deg F][0 to 250 deg F and 0 to 150 deg C].
3. [30 to 240 deg F][30 to 240 deg F and 0 to plus 115 deg C].
4. [50 to 400 deg F][50 to 400 deg F and 0 to 200 deg C].

E. Scale Range for Air Ducts:

1. [Minus 40 to plus 110 deg F][Minus 40 to plus 110 deg F and minus 40 to plus 45 deg C].
2. [Minus 40 to plus 160 deg F][Minus 40 to plus 160 deg F and minus 40 to plus 100 deg C].
3. [0 to 100 deg F][0 to 100 deg F and minus 20 to plus 50 deg C].
4. [0 to 150 deg F][0 to 150 deg F and minus 20 to plus 70 deg C].
5. [0 to 250 deg F][0 to 250 deg F and 0 to 150 deg C].
6. [20 to 240 deg F][20 to 240 deg F and 0 to 150 deg C].
7. [30 to 240 deg F][30 to 240 deg F and 0 to plus 115 deg C].
8. [50 to 400 deg F][50 to 400 deg F and 0 to 200 deg C].

3.16 PRESSURE-GAUGE APPLICATION

A. Pressure gauges at discharge of each pressure-reducing valve are to be the following:

1. [Liquid filled][Sealed][Open front, pressure relief][Solid front, pressure relief]<Insert type>, [direct][remote] mounted, metal case.
2. [Sealed]<Insert type>, [direct][remote] mounted, plastic case.
3. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

B. Pressure gauges at inlet and outlet of each chiller chilled-water and condenser-water connection are to be the following:

1. [Liquid filled][Sealed][Open front, pressure relief][Solid front, pressure

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relief]<Insert type>, [direct][remote] mounted, metal case.
2. [Sealed]<Insert type>, [direct][remote] mounted, plastic case.
3. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

C. Pressure gauges at suction and discharge of each pump are to be the following:

1. [Liquid-filled][Sealed][Open front, pressure relief][Solid front, pressure relief]<Insert type>, [direct][remote] mounted, metal case.
2. [Sealed]<Insert type>, [direct][remote] mounted, plastic case.
3. Test plug with [chlorosulfonated polyethylene synthetic][EPDM] self-sealing rubber inserts.

3.17 PRESSURE-GAUGE SCALE-RANGE APPLICATION

A. Scale Range for Chilled-Water Piping:

1. [30 in. Hg to 15 psi][30 in. Hg to 15 psi and minus 100 to 0 kPa].
2. [0 to 30 psi][0 to 30 psi and 0 to 240 kPa].
3. [0 to 100 psi][0 to 100 psi and 0 to 600 kPa].
4. [0 to 160 psi][0 to 160 psi and 0 to 1100 kPa].
5. [0 to 200 psi][0 to 200 psi and 0 to 1400 kPa].
6. [0 to 300 psi][0 to 300 psi and 0 to 2500 kPa].
7. [0 to 600 psi][0 to 600 psi and 0 to 4000 kPa].

B. Scale Range for Condenser-Water Piping:

1. [30 in. Hg to 15 psi][30 in. Hg to 15 psi and minus 100 to 0 kPa].
2. [0 to 30 psi][0 to 30 psi and 0 to 240 kPa].
3. [0 to 100 psi][0 to 100 psi and 0 to 600 kPa].
4. [0 to 160 psi][0 to 160 psi and 0 to 1100 kPa].
5. [0 to 200 psi][0 to 200 psi and 0 to 1400 kPa].
6. [0 to 300 psi][0 to 300 psi and 0 to 2500 kPa].
7. [0 to 600 psi][0 to 600 psi and 0 to 4000 kPa].

C. Scale Range for Heating, Hot-Water Piping:

1. [30 in. Hg to 15 psi][30 in. Hg to 15 psi and minus 100 to 0 kPa].
2. [0 to 30 psi][0 to 30 psi and 0 to 240 kPa].
3. [0 to 100 psi][0 to 100 psi and 0 to 600 kPa].
4. [0 to 160 psi][0 to 160 psi and 0 to 1100 kPa].
5. [0 to 200 psi][0 to 200 psi and 0 to 1400 kPa].
6. [0 to 300 psi][0 to 300 psi and 0 to 2500 kPa].
7. [0 to 600 psi][0 to 600 psi and 0 to 4000 kPa].

D. Scale Range for Steam Piping:

1. [30 in. Hg to 15 psi][30 in. Hg to 15 psi and minus 100 to 0 kPa].
2. [0 to 30 psi][0 to 30 psi and 0 to 240 kPa].
3. [0 to 100 psi][0 to 100 psi and 0 to 600 kPa].

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4. [0 to 160 psi][0 to 160 psi and 0 to 1100 kPa].
5. [0 to 200 psi][0 to 200 psi and 0 to 1400 kPa].
6. [0 to 300 psi][0 to 300 psi and 0 to 2500 kPa].
7. [0 to 600 psi][0 to 600 psi and 0 to 4000 kPa].

3.18 FLOWMETER APPLICATION

A. Flowmeters for Chilled-Water Piping: [Orifice][Pitot-tube][Turbine][Venturi][Vortex-shedding] type.

B. Flowmeters for Condenser-Water Piping: [Orifice][Pitot-tube][Turbine][Venturi][Vortex-shedding] type.

C. Flowmeters for Heating, Hot-Water Piping: [Orifice][Pitot-tube][Turbine][Venturi][Vortex-shedding] type.

D. Flowmeters for Steam and Steam-Condensate Piping: [Orifice][Turbine][Venturi][Vortex-shedding] type.

3.19 THERMAL-ENERGY METER APPLICATION

A. Thermal-Energy Meters for Chilled-Water Piping: [Turbine][Ultrasonic] type.

B. Thermal-Energy Meters for Condenser-Water Piping: [Turbine][Ultrasonic] type.

C. Thermal-Energy Meters for Heating, Hot-Water Piping: [Turbine][Ultrasonic] type.

D. Thermal-Energy Meters for Steam and Steam-Condensate Piping: [Turbine][Ultrasonic] type.

END OF SECTION 230500

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers - metal, trapeze type.
2. Pipe hangers - FRP.
3. Strut support system - rooftop-mounted pipe stand, curb-mounted type.
4. Fastener system - mechanical expansion anchors.
5. Equipment supports.
6. Equipment stands - outdoor type.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230500 "Common Work Results for HVAC" for pipe guides and anchors.
3. [**Section 230548 "Vibration and Seismic Controls for HVAC"**][**Section 230548.13 "Vibration Controls for HVAC"**] for vibration isolation devices.
4. [**Section 233113 "Metal Ducts"**][**and**][**Section 233116 "Nonmetal Ducts"**] for duct hangers and supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:[**Signed and sealed by a qualified professional engineer.**] Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal strut support systems.
3. Rooftop-mounted strut support systems.
4. FRP strut support systems.
5. Pipe stands.
6. Equipment supports.

C. Delegated Design Submittals: For [**trapeze hangers**][**and**][**strut support systems**] indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication/assembly and design calculations for [**trapeze hangers**][**strut support systems**].
2. Detail fabrication/assembly and design calculations for each type of strut support

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system, by the manufacturer's technical representative.

D. Sustainable Design Submittals:

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design [**trapeze hangers**][**, strut support systems,**][**and**] equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment are to withstand the effects of gravity loads and stresses within limits and under conditions indicated in accordance with [**ASCE/SEI 7**]<**Insert requirement**>.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment[**and obtain approval from authorities having jurisdiction**].

2.2 MATERIALS

A. Aluminum: **ASTM B221**.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor

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applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000 psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry static loads within specified loading limits. Minimum static design load used for strength determination is to include weight of supported components plus [200 lb]<**Insert value**>.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

B. Install lateral bracing with pipe hangers and supports to prevent swaying.

C. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [NPS 2-1/2]<**Insert pipe size**> and larger[**and at changes in direction of piping**]. Coordinate location of concrete inserts before concrete is placed.

D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

F. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal hanger

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shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields are to span an arc of 180 degrees.

   a. Thermal hanger shield inserts may be used as an option. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048 inch thick.
   b. NPS 4 (DN 100): 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

G. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

H. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate in accordance with ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel in accordance with AWS D1.1/D1.1M.

I. FRP Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

J. Strut System Installation: [**Metal, rod type**][**Metal, cable type**][**FRP**]. Arrange for

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grouping of parallel runs of piping, and support together on field-assembled strut systems. Install in accordance with manufacturer's written installation instructions.

K. Thermal Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

L. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick after concrete is placed and cured. Use installers that are trained and certified [by power tool manufacturer][in accordance with the AHJ].
2. Install mechanical-expansion anchors after concrete is placed and completely cured.
3. Install fasteners in accordance with manufacturer's written instructions.
4. Install lag screw wood fasteners in accordance with manufacturer's written instructions.

M. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

N. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

O. Equipment Support Installation:

1. Fabricate from welded-structural-steel shapes.
2. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
3. Grouting: Place grout under supports for floor-mounted equipment, and make bearing surface smooth.
4. Provide lateral bracing, to prevent swaying.

3.3 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

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E. Use carbon-steel [**pipe hangers and supports**][**metal trapeze pipe hangers**][**and**][**metal framing systems**] and attachments for general service applications.

F. Use [**stainless steel pipe hangers**][**FRP pipe hangers**][**and**][**FRP strut systems**] and [**stainless steel**][**or**][**corrosion-resistant**] attachments for hostile environment applications.

G. Use copper-plated pipe hangers and [**copper**][**or**][**stainless steel**] attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for

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pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if

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loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

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7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use [**powder-actuated fasteners**][**or**][**mechanical-expansion anchors**] instead of building attachments where required in concrete construction.

END OF SECTION 230529

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. TAB of Air Systems:

   a. Constant-volume air systems.
   b. Dual-duct systems.
   c. Variable-air-volume systems.
   d. Multizone systems.
   e. Induction-unit systems.

2. TAB of Hydronic Piping Systems:

   a. Constant-flow hydronic systems.
   b. Variable-flow hydronic systems.
   c. Primary-secondary hydronic systems.

3. TAB of fuel oil systems for HVAC.
4. TAB of steam and condensate piping systems.
5. TAB of equipment.
6. TAB of existing HVAC systems and equipment.
7. Procedures for exhaust hoods.
8. Sound tests.
9. Vibration tests.
10. Duct-leakage tests verification.
11. Pipe-leakage tests verification.
12. UFAD plenum-leakage tests verification.
13. HVAC-control system verification.
14. Smoke-control system tests.
15. Stair-pressurization system tests.
16. Elevator-pressurization system tests.

B. Related Requirements:

1. Section 220593 "Testing, Adjusting, and Balancing for Plumbing" for TAB of plumbing systems and equipment.

1.2 PREINSTALLATION MEETINGS

A. TAB Conference: Conduct a TAB conference at [**Project site**]<**Insert location**> after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of [**14**]<**Insert number**> days' advance

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notice of scheduled meeting time and location.

1. Minimum Agenda Items:

    a. The Contract Documents examination report.
    b. The TAB plan.
    c. Requirements for coordination and cooperation of trades and subcontractors.
    d. Proposed procedures for documentation and communication flow.
    e. <Insert additional agenda items as required>.

1.3 ACTION SUBMITTALS

A. Sustainable Design Submittals:

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within [30][45][60][90]<Insert number> days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within [30][60][90]<Insert number> days of Contractor's Notice to Proceed, provide a summary report of the examination review required in "Examination" Article, if issues are discovered that may preclude the proper testing and balancing of the systems. Submit a summary report of the examination review required in "Examination" Article.

C. Strategies and Procedures Plan: Within [30][60][90]<Insert number> days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.

D. System Readiness Checklists: Within [30][60][90]<Insert number> days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article, to be used and filled out by systems installers verifying that systems are ready for TAB.

E. Certified TAB Reports: Within [14][21][30]<Insert number> days of completion of testing and balancing work.

    1. Submit one copy of the final TAB report to the design professional of record's firm. Provide [five]<Insert number> additional copies to Contractor.

F. Sample report forms.

G. Instrument calibration reports, to include the following:

    1. Instrument type and make.
    2. Serial number.
    3. Application.

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4. Dates of use.
5. Dates of calibration and calibration interval.

1.5 QUALITY ASSURANCE

A. TAB Specialist Firm's Qualifications, Certified by AABC:

1. TAB Field Supervisor: Employee of the TAB specialist firm and certified by AABC.
2. TAB Technician: Employee of the TAB specialist firm and certified by AABC.

B. TAB Specialist Firm's Qualifications: Certified by [**NEBB**][**or**][**TABB**].

1. TAB Certified Professional: Employee of the TAB specialist firm and certified by [**NEBB**][**or**][**TABB**].
2. TAB Technician: Employee of the TAB specialist firm and certified by [**NEBB**][**or**][**TABB**].
3. TAB specialist firm is to be independent, third-party, and unaffiliated with Contractor.

C. Sound and Vibration Specialists: [**NEBB-certified Sound and Vibration Technician**][**TABB-certified Sound and Vibration Technician**][**INCE Board-certified professional**][**Vibration Institute Category I Certified Vibration Analyst**][**Vibration Institute Category II Certified Vibration Analyst**][**Vibration Institute Category III Certified Vibration Analyst**][**Vibration Institute Category IV Certified Vibration Analyst**][**or**][**Licensed professional engineer who specializes in acoustical engineering**]<**Insert sound and vibration certification**>.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

E. ASHRAE 111 compliance for testing and balancing of HVAC systems.

F. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.3.3 - "System Balancing."

G. Code and Authorities Having Jurisdiction Compliance: Furnish TAB services that comply with governing codes and requirements of authorities having jurisdiction.

1.6 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

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PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare single-line schematic diagram of systems or color-coded HVAC drawings for the purpose of identifying HVAC components, including each air terminal unit and each air diffuser, register, and grille.

C. For variable-air-volume systems, develop a plan to simulate diversity and include in TAB plan.

D. Determine suitable locations in main and branch ducts for accurate duct-airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.

F. Verify that motor controllers are equipped with properly sized thermal protection.

3.2 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet.
    b. Measure static pressure directly at the fan inlet.
    c. Measure static pressure differential across each component that makes up the air-handling system.
    d. Apply artificial loading of filters to simulate a dirty filter pressure drop condition at the time static pressures are measured.

3. Obtain approval from [Architect][Owner][Construction Manager][Commissioning Authority] for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit

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performance.

4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all volume dampers have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets' and outlets' airflow. Apply correction factors as applicable for each size and style of air device.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design range. Readjust to within design tolerance if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Traverse the supply airflow in full airside economizer mode. Observe the mixed air plenum pressure as compared to normal operation: return air dampers open and minimum outside air varying to 100 percent outside air dampers fully open and return air dampers fully closed. Mixed air pressure is to remain constant plus/minus 20 percent or, otherwise, damper/fan adjustments will be required.
5. Mark all final settings.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.3 PROCEDURES FOR DUAL-DUCT SYSTEMS

A. Adjust the dual-duct systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge. On systems with separate hot-deck and cold-deck fans, verify the location of the sensor on each deck.
2. Verify that the system is under static pressure control.
3. Verify that the high static pressure safety is set below the maximum static pressure rating of the ductwork.
4. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point, so the

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entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses. Perform this procedure for the hot deck and for the cold deck.

5. Calibrate and balance each terminal unit's hot deck and cold deck for maximum and minimum design airflow as follows:

    a. Adjust controls so that terminal is calling for full cooling. Some controllers require starting with minimum set point. Verify calibration procedure for specific project.
    b. Measure airflow and adjust calibration factors as required for design cold-deck maximum airflow and hot-deck minimum airflow. Record calibration factors.
    c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
    d. Adjust controls so that terminal is calling for full heating.
    e. Measure airflow and adjust calibration factors as required for design cold-deck minimum airflow and hot-deck maximum airflow. Record calibration factors. If no minimum calibration is available, note any deviation from design airflow. Verify that the airflow when damper is closed is zero.

6. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Set terminals for maximum airflow. If system design includes diversity (cooling coil or fan), adjust terminals for maximum and minimum airflow so that connected total matches cooling coil or fan selection and simulates actual load in the building. In systems with separate hot-deck and cold-deck fans, diversity consideration applies to each individual fan.
    c. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.

7. Measure the fan(s) static pressures as follows:

    a. Measure static pressure directly at the fan outlet.
    b. Measure static pressure directly at the fan inlet.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report any artificial loading of filters at the time static pressures are measured.

8. Set final return and outside airflow to the fan(s) while operating at maximum return airflow and minimum outdoor airflow.

    a. Balance the return-air ducts and inlets.
    b. Verify that all terminal units are delivering design airflow under system

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maximum flow.

9. Re-measure the inlet static pressure at the most critical terminal unit, and adjust the system static pressure set point to the most energy-efficient set point, to maintain the optimum system static pressure. Record set point and give to controls Contractor.
10. Verify final system conditions as follows:

    a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to deliver within design value tolerances if necessary.
    b. Re-measure and confirm that total airflow is within design value tolerances.
    c. Re-measure final fan operating data, speed, volts, amps, and static profile.
    d. Mark final settings.
    e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
    f. Verify tracking between supply and return fans via air flow measurements in the supply, return, relief, and outside air flow paths.

11. Record final fan-performance data.

3.4 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:

    a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
    b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
    c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
    d. Adjust controls so that terminal is calling for minimum airflow.
    e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
    f. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of

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full cooling to full heating. Note any deviation from design airflow or room pressure.

5. Set the air terminal units to maximum airflow. Record the following for each air terminal unit:

    a. Design maximum airflow.
    b. Tested and balanced maximum airflow.
    c. BAS system maximum airflow.
    d. BAS damper position.
    e. Adjust the air-handling unit fan airflow until one air terminal unit damper position is 85 percent open.
    f. Record the duct static pressure sensor and set the fan static pressure controller to the recorded static pressure sensor.
    g. Record the fan operating Hz.
    h. If the system has filters that will exceed 0.5 inch wg pressure differential when dirty, simulate the dirty filter pressure drop and repeat all the above recorded readings ("a" through "g"), noting dirty filter condition.
    i. With N+1, isolate one fan and repeat all the above recorded readings ("a" through "g"), noting N+1 condition.
    j. Each condition must have all air-handling- unit data recorded, including static pressure profiles at outdoor air, return air, relief air, total supply air, supply air fan suction and discharge, return air fan suction and discharge, and relief air fan suction and discharge.

6. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet.
    b. Measure static pressure directly at the fan inlet.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Balance the return-air ducts and inlets.
    b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit, and adjust the system static pressure set point to the most energy-efficient set point, to maintain the optimum system static pressure. Record set point and give to controls Contractor.
9. Verify final system conditions as follows:

    a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
    b. Re-measure and confirm that total airflow is within design.
    c. Re-measure final fan operating data, speed, volts, amps, and static profile.

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d. Mark final settings.
e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
f. Verify tracking between supply and return fans.

3.5 PROCEDURES FOR MULTIZONE SYSTEMS

A. Position the unit's automatic zone dampers for maximum flow through the cooling coil.

B. The procedures for multizone systems will utilize the zone balancing dampers to achieve the indicated airflow within the zone.

C. After balancing, place the unit's automatic zone dampers for maximum heating flow. Retest zone airflows and record any variances.

D. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor air conditions.
b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet.
b. Measure static pressure directly at the fan inlet.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review record Drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from [Architect][Owner][Construction Manager][Commissioning Authority] for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

E. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

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1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

F. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlet and outlet airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

G. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR INDUCTION-UNIT SYSTEMS

A. Balance primary-air risers by measuring static pressure at the nozzles of the top and bottom units of each riser, to determine which risers must be throttled. Adjust risers to indicated airflow within specified tolerances.

B. Adjust each induction unit.

C. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet.
    b. Measure static pressure directly at the fan inlet.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

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3. Review record Drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from [Architect][Owner][Construction Manager][Commissioning Authority] for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

E. Balance airflow to each induction unit by measuring the nozzle pressure and comparing it to the manufacturer's published data for nozzle pressure versus cfm. Adjust the unit's inlet damper to achieve the required nozzle pressure for design cfm.

F. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speeds, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and other equipment. Obtain approved submittals and manufacturer-recommended testing procedures. Cross-check the summation of required coil and equipment flow rates with pump design flow rate.

B. Prepare single-line schematic diagram of systems for the purpose of identifying HVAC components.

C. Prepare schematic diagrams of systems' record Drawings piping layouts.

D. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:

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1. Check expansion tank for proper setting.
2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.
5. Verify that motor controllers are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

E. Measure and record upstream and downstream pressure of each piece of equipment.

F. Measure and record upstream and downstream pressure of pressure-reducing valves.

G. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.

1. Check settings and operation of each safety valve. Record settings.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design flow.

1. Measure total water flow.

a. Position valves for full flow through coils.
b. Measure flow by main flow meter, if installed.
c. If main flow meter is not installed, determine flow by pump TDH or known equipment pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
c. Convert pressure to head and correct for differences in gauge heights.
d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved. If excessive throttling is required to achieve desired flow, recommend pump impellers be trimmed to reduce excess throttling. Before pump impellers are trimmed, verify if any future load requirements and close throttling valve, noting the position.

3. Monitor motor performance during procedures, and do not operate motor in an overloaded condition. While operating pump(s) at maximum flow conditions, verify pump(s) are operating below nameplate and are non-overloading through full range of operation.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.

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1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.
2. Adjust each terminal to design flow.
3. Re-measure each terminal after it is adjusted.
4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.
6. Use coil pressure drop to determine flow if no flow meter measurement exists.
7. Use temperatures and flows to calculate actual capacity on each coil and heat exchanger.

D. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been verified.

E. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or by capacity method calculation.
2. Use coil pressure drop to determine flow.
3. Perform temperature tests after flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

G. Verify that memory stops have been set. Add and mark all balanced valve positions for valves that do not have memory stops.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

B. Adjust the variable-flow hydronic system as follows:

1. Verify that the pressure-differential sensor(s) is located as indicated.
2. Determine whether there is diversity in the system.

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C. For systems with no flow diversity:

1. Adjust pumps to deliver total design flow with variable frequency drive(s) set to 60 Hz.

    a. Measure total water flow.

        1) Position valves for full flow through coils.
        2) Measure flow by main flow meter, if installed.
        3) If main flow meter is not installed, determine flow by pump TDH or known equipment pressure drop.

    b. Measure pump TDH as follows:

        1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
        2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
        3) Convert pressure to head and correct for differences in gauge heights.
        4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.

    c. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved. If excessive throttling is required to achieve desired flow, recommend pump impellers be trimmed to reduce excess throttling. Before pump impellers are trimmed, verify future load requirements and close throttling valve, noting the position.

2. Monitor motor performance during procedures, and do not operate motor in an overloaded condition. While operating pump(s) at maximum flow conditions, verify pump(s) are operating below nameplate and are non-overloading through full range of operation.
3. Adjust flow-measuring devices installed in mains and branches to design water flows.

    a. Measure flow in main and branch pipes.
    b. Adjust main and branch balance valves for design flow by using manually balancing valve.
    c. Re-measure each main and branch after all have been adjusted.

4. Adjust flow-measuring devices installed at terminals for each space to design water flows.

    a. Measure flow at terminals.
    b. Adjust each terminal to design flow.
    c. Re-measure each terminal after it is adjusted.
    d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
    e. Perform temperature tests after flows have been balanced.

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5. For systems with pressure-independent valves at terminals:

    a. Measure differential pressure and verify that it is within manufacturer's specified range.
    b. Perform temperature tests after flows have been verified.

6. For systems without pressure-independent valves or flow-measuring devices at terminals:

    a. Measure and balance coils by either coil pressure drop or temperature method.
    b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

7. Prior to verifying final system conditions, determine the system pressure-differential set point(s).
8. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, verify the pressure at the controller sensor and set the controller to the measured pressure at completion, open discharge valve 100 percent, and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions. Reverify the pressure at the controller.
9. Mark final settings and verify that all memory stops have been set.
10. Verify final system conditions as follows:

    a. Re-measure and confirm that total flow is within design.
    b. Re-measure final pumps' operating data, TDH, volts, amps, speed, static pressure profile, and variable-frequency drive Hz.
    c. Mark final settings.

D. For systems with flow diversity:

1. Determine diversity factor.
2. Simulate system diversity by closing required number of control valves located closest to the pump(s).
3. Adjust pumps to deliver total design flow.

    a. Measure total water flow.

        1) Position valves for full flow through coils.
        2) Measure flow by main flow meter, if installed.
        3) If main flow meter is not installed, determine flow by pump TDH or known equipment pressure drop.

    b. Measure pump TDH as follows:

        1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
        2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
        3) Convert pressure to head and correct for differences in gauge

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heights.

4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.

c. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved. If excessive throttling is required to achieve desired flow, recommend pump impellers be trimmed to reduce excess throttling. Before pump impellers are trimmed, verify future load requirements and close throttling valve, noting the position.

4. Monitor motor performance during procedures, and do not operate motor in an overloaded condition. While operating pump(s) at maximum flow conditions, verify pump(s) are operating below nameplate and are non-overloading through full range of operation.
5. Adjust flow-measuring devices installed in mains and branches to design water flows.

a. Measure flow in main and branch pipes.
b. Adjust main and branch balance valves for design flow.
c. Re-measure each main and branch after all have been adjusted.

6. Adjust flow-measuring devices installed at terminals for each space to design water flows.

a. Measure flow at terminals.
b. Adjust each terminal to design flow.
c. Re-measure each terminal after it is adjusted.
d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
e. Perform temperature tests after flows have been balanced.

7. For systems with pressure-independent valves at terminals:

a. Measure differential pressure, and verify that it is within manufacturer's specified range.
b. Perform temperature tests after flows have been verified.

8. For systems without pressure-independent valves or flow-measuring devices at terminals:

a. Measure and balance coils by either coil pressure drop or temperature method.
b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

9. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
10. Prior to verifying final system conditions, determine system pressure-differential set point(s).

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11. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion, open discharge valve 100 percent, and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
12. Mark final settings and verify that memory stops have been set.
13. Verify final system conditions as follows:

    a. Re-measure and confirm that total water flow is within design.
    b. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
    c. Mark final settings.

3.10 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first.

B. Balance the secondary circuits after the primary circuits are complete.

C. Adjust pumps to deliver total design flow.

1. Measure total water flow.

    a. Position valves for full flow through coils.
    b. Measure flow by main flow meter, if installed.
    c. If main flow meter is not installed, determine flow by pump TDH or known equipment pressure drop.

2. Measure pump TDH as follows:

    a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
    b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
    c. Convert pressure to head and correct for differences in gauge heights.
    d. Verify pump impeller size by measuring TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size. Before pump impellers are trimmed, verify future load requirements and close throttling valve, noting the position.
    e. With valves open, read pump TDH. Adjust pump discharge valve or speed until design water flow is achieved. If excessive throttling is required to achieve desired flow, recommend pump impellers be trimmed to reduce excess throttling. Before pump impellers are trimmed, verify future load requirements and close throttling valve, noting the position.

3. Monitor motor performance during procedures, and do not operate motor in an overloaded condition. While operating pump(s) at maximum flow conditions, verify pump(s) are operating below nameplate and are non-overloading through full range of operation.

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D. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

E. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.
2. Adjust each terminal to design flow.
3. Re-measure each terminal after it is adjusted.
4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

F. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been balanced.

G. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.
2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

H. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
3. Mark final settings.

I. Verify that memory stops have been set.

3.11 PROCEDURES FOR STEAM AND CONDENSATE SYSTEMS

A. Measure and record upstream and downstream pressure of each piece of equipment.

B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.

C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.

D. Check settings and operation of each safety valve. Record settings.

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E. Verify the operation of each steam trap.

3.12 PROCEDURES FOR STAIR-PRESSURIZATION SYSTEMS

A. Before testing, observe each pressurized stair enclosure to verify construction is complete. Verify the following:

1. Walls and ceiling are free of unintended openings and are capable of achieving a pressure boundary.
2. Firestopping and sealants are installed.
3. Doors, door closers, and door gaskets are installed and adjusted.
4. If applicable, window installation is complete.
5. Stair-pressurization fans and associated controls are installed and functioning properly.
6. Stair-pressurization duct distribution and air outlets are installed.
7. Life-safety dampers (smoke or combination fire and smoke) are installed and functioning properly.

B. Measure and record barometric pressure, wind speed and direction, outdoor-air temperature, and relative humidity on each test day.

C. Test each stair enclosure as a single system. If multiple fans serve a single stair enclosure, operate fans as intended by the design.

D. Initial Air Balance:

1. Open doors to floors where indicated by design and measure, adjust, and record the airflow of each of the following:

a. Stair-pressurization fan. For ducted systems, measure fan airflow by duct Pitot-tube traverse unless duct distribution does not permit accurate readings.
b. Air outlet supplying stair enclosure.
c. Adjust enclosure total airflow to achieve design pressurization.
d. Adjust method of stair enclosure pressure relief to prevent overpressurization.

E. Pressurization Test and Adjustments:

1. After air balancing is complete, perform stair enclosure-pressurization tests.
2. Establish a consistent procedure for recording data throughout entire test.
3. Use stair side of doors as pressure reference point.

a. Positive Pressure: Floor side of door higher than stair side.
b. Negative Pressure: Floor side of door lower than stair side.

4. With HVAC systems and stair-pressurization systems off, measure and record the following:

a. Pressure difference across each stair enclosure door, with all doors in the

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stair enclosure closed.
b. Force necessary to open each door, using a spring-type scale.
c. Adjustment needed to achieve design pressurization of enclosure total airflow.
d. Adjustment needed to method of stair enclosure pressure relief, to prevent overpressurization.

5. With HVAC systems operating in normal mode and stair-pressurization systems off, measure and record the following:

a. Pressure difference across each stair enclosure door, with all doors in the stair enclosure closed.
b. Force necessary to open each door, using a spring-type scale.
c. Adjustment needed to achieve design pressurization of enclosure total airflow.
d. Adjustment needed to method of stair enclosure pressure relief, to prevent overpressurization.

6. With HVAC systems and stair-pressurization system operating simultaneously, perform the following:

a. Place HVAC systems in normal operating mode, including equipment not used to implement smoke control, such as air-handling units, exhaust fans, and similar equipment.
b. Measure and record pressure difference across each stair enclosure door, with all doors in stair enclosure closed.
c. Use a spring scale to measure and record the force needed to open all stair enclosure doors.
d. Adjust enclosure total airflow to achieve design pressurization.
e. Adjust method of stair enclosure pressure relief to prevent overpressurization.
f. Additional Tests for Designs with Open Doors:

1) With exit door to outdoors in open position, measure and record pressure difference across each of the remaining closed stair enclosure doors.
2) Open additional doors (up to the number indicated by design) one at a time, and measure and record pressure difference across each remaining closed stair enclosure door after the opening of each additional door.
3) For each different test condition, measure and record the direction and velocity through each of the open doors by a traverse of every [1 sq. ft.]<**Insert requirement**> grid of door opening.
4) For each different test condition, calculate average of door velocity measurements. Compare average velocity to design and governing code requirements.
5) Adjust enclosure total airflow to achieve design pressurization.
6) Adjust method of stair enclosure pressure relief to prevent overpressurization.

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7. Repeat pressurization tests with the smoke-control systems and HVAC systems operating.
8. Criteria for Acceptance:

    a. Compliance with design requirements.
    b. Compliance with code requirements.
    c. Compliance with additional requirements required by authorities having jurisdiction.
    d. <**Insert criteria**>.

F. Operational Tests:

1. Check proper activation of stair-pressurization system(s) in response to all means of activation, both automatic and manual.
2. Verify that each initiating occurrence produces the proper system response under each of the following modes of operation:

    a. Normal.
    b. Alarm.
    c. Manual override.
    d. Return to normal.

3. Verify smoke detector at pressurization fan de-energizes fan and closes isolation damper when smoke detector is activated and in alarm.
4. If standby power is provided for pressurization systems, test to verify pressurization systems operate while on both normal and standby power.
5. Check operation in accordance with design indicated.

G. Authority Having Jurisdiction Tests: Conduct additional tests required by authorities having jurisdiction.

H. Report: Prepare and submit a complete report of observations, measurements, and deficiencies. Include names and contact information of individuals conducting tests and of individuals witnessing tests.

3.13 PROCEDURES FOR ELEVATOR-PRESSURIZATION SYSTEMS

A. Before testing, observe each pressurized elevator enclosure to verify construction is complete. Verify the following:

1. Walls and ceiling are free of unintended openings and are capable of achieving a pressure boundary.
2. Firestopping and sealants are installed.
3. Doors are installed and adjusted. Elevator car doors are recalled to the default recall floor, and elevator car doors on recall floor are open.
4. If applicable, window installation is complete.
5. Pressurization fans and associated controls are installed and functioning properly.
6. Pressurization duct distribution and air outlets are installed.
7. Life-safety dampers (smoke or combination fire and smoke) are installed and

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functioning properly.

B. Measure and record barometric pressure, wind speed and direction, outdoor-air temperature, and relative humidity on each test day.

C. Test each elevator enclosure as a single system. If multiple fans serve a single elevator enclosure, operate fans as intended by the design.

D. Initial Air Balance:

1. Open elevator car doors to recall floor indicated by design, and measure, adjust, and record the airflow of each:

    a. Pressurization fan. For ducted systems, measure fan airflow by duct pitot-tube traverse unless duct distribution does not permit accurate readings.
    b. Air outlet supplying elevator enclosure.
    c. Adjustment needed to achieve design pressurization of enclosure total airflow.
    d. Adjustment to method of elevator enclosure pressure relief, to prevent overpressurization.

E. Pressurization Tests and Adjustments:

1. After air balancing is complete, perform elevator enclosure pressurization tests.
2. Establish a consistent procedure for recording data throughout entire test.
3. Use elevator car side of doors as pressure reference point.

    a. Positive Pressure: Floor side of door higher than elevator car side.
    b. Negative Pressure: Floor side of door lower than elevator car side.

4. With HVAC systems and elevator-pressurization systems off, measure and record the following:

    a. Pressure difference across each elevator enclosure door, with all doors in the elevator enclosure closed.
    b. Adjustment needed to achieve design pressurization of enclosure total airflow.
    c. Adjustment needed to method of stair enclosure pressure relief, to prevent overpressurization.

5. With HVAC systems operating in normal mode and elevator pressurization systems off, measure and record the following:

    a. Pressure difference across each elevator enclosure door, with all doors in the elevator enclosure closed.
    b. Adjustment needed to achieve design pressurization of enclosure total airflow.
    c. Adjustment needed to method of stair enclosure pressure relief, to prevent overpressurization.

6. With HVAC systems and elevator pressurization system operating

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simultaneously, perform the following:

a. Place HVAC systems in normal operating mode, including equipment not used to implement smoke control, such as air-handling units, exhaust fans, and similar equipment.
b. Measure and record pressure difference across each stair enclosure door, with all doors in stair enclosure closed.
c. Adjust enclosure total airflow to achieve design pressurization.
d. Adjust method of elevator enclosure pressure relief to prevent overpressurization.

7. Repeat pressurization tests with smoke-control systems and HVAC systems operating.
8. Criteria for Acceptance:

a. Compliance with design requirements.
b. Compliance with code requirements.
c. Compliance with additional requirements of authorities having jurisdiction.
d. <Insert criteria>.

F. Operational Tests:

1. Check proper activation of elevator-pressurization system(s) in response to all means of activation, both automatic and manual.
2. Verify that each initiating occurrence produces the proper system response under each of the following modes of operation:

a. Normal.
b. Alarm.
c. Manual override.
d. Return to normal.

3. Verify smoke detector at pressurization fan de-energizes fan and closes isolation damper when smoke detector is activated and in alarm.
4. If standby power is provided for pressurization systems, test to verify pressurization systems operate while on both normal and standby power.
5. Check operation in accordance with design indicated.

G. Authority Having Jurisdiction Tests: Conduct additional tests required by authorities having jurisdiction.

H. Report: Prepare and submit a complete report of observations, measurements, and deficiencies. Include names and contact information of individuals conducting tests and of individuals witnessing tests.

3.14 PROCEDURES FOR SMOKE-CONTROL SYSTEM TESTING

A. Before testing smoke-control systems, review design documents to understand operating requirements and design intent:

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1. Review boundaries of each smoke zone.
2. Review location, size, and operating characteristics of equipment, such as smoke and fire smoke dampers.
3. Review sequence of operation, smoke-control matrix, operating status of equipment, and position of smoke and fire dampers for each smoke zone alarm condition.
4. Review location and type of alarm detection used to initiate smoke control for each smoke zone.
5. Review other smoke-control system attributes not listed but required for code compliance and acceptance by authorities having jurisdiction.

B. Before testing smoke-control systems, verify that construction is complete and verify the integrity of each smoke-control zone boundary.

1. Verify that windows, doors, walls, ceilings, and floors (six-sided boundary) are closed and that applicable safing, gasket, and firestops and sealants are installed.
2. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

C. Measure and record barometric pressure, wind speed and direction, outdoor-air temperature, and relative humidity on each test day.

D. Measure, adjust, and record airflow of each smoke-control system, with all fans that are a part of system operating as intended by the design.

1. Measure, adjust, and record the airflow of each fan. For ducted systems, measure fan airflow by duct Pitot-tube traverse.
2. Measure, adjust, and record the airflow of each exhaust inlet and supply outlet.
3. Measure, adjust, and record airflow in main and branch ducts.

E. Smoke Control by Pressurization: After air balancing is complete, perform the following pressurization testing for each smoke-control zone in the system designed for isolation by using pressurization boundaries:

1. Verify the boundaries of each smoke-control zone.
2. With the HVAC systems in their normal mode of operation and smoke control not operating, measure and record the pressure difference across each smoke-control zone. Make measurements after closing doors that separate the zones. Make one measurement across each door. Clearly indicate the high- and low-pressure side of each door.
3. With the system operating in the smoke-control mode and with each separate zone in the smoke-control system activated, perform the following:

a. Measure and record the pressure difference across each door that separates the smoke zone from adjacent zones.

1) Make measurements with doors that separate the smoke zone from the other zones closed.
2) Clearly indicate the high- and low-pressure side of the door.
3) Doors that have a tendency to open slightly due to the pressure

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difference should have one pressure measurement made while held closed and another measurement made with the door open.

b. Continue to activate each separate smoke zone within each smoke-control system and make pressure-difference measurements.
c. After testing a smoke zone's smoke-control system, deactivate the HVAC systems involved and return them to their normal operating mode before activating another zone's smoke-control system.
d. Verify that controls necessary to prevent excessive pressure differences are functional and operating within design set points and limits.

F. Smoke-Control Systems for Atriums and Other Large-Volume Spaces: After air balancing is complete, perform the following testing for each smoke-control system serving atriums and other large-volume spaces:

1. Verify and document the boundaries served by each smoke-control system.
2. Identify and document closed doors, open doors, and other boundary openings to be left open to adjacent areas and that are to be protected by airflow alone.
3. With the HVAC systems in their normal mode of operation and smoke-control systems not operating, measure and record the following:

a. Pressure difference across each door that separates the smoke-zone from adjacent zones.
b. Velocity for each point in traverse across each boundary opening:

1) Clearly indicate the direction of flow.
2) Measure velocity across opening on [12-inch]<Insert dimension> centers using a vane anemometer. Calculate and report airflow.

4. With system operating in the smoke-control mode, measure and record the following:

a. Pressure difference across each door that separates the smoke zone from adjacent zones.
b. Velocity for each point in traverse across each opening:

1) Clearly indicate the direction of flow.
2) Measure velocity across opening on [12-inch]<Insert dimension> centers using a vane anemometer. Calculate and report airflow.

5. Verify system operation and make adjustments to achieve design pressure differences and air velocities within design set points and upper operating limits.

G. Operational Tests: As described in the sequences of operation and in the smoke-control matrix.

1. Check the proper activation of each zone of each smoke-control system in response to all means of activation, both automatic and manual.
2. Check automatic activation in response to fire alarm signals received from the building's fire alarm system. Initiate a separate alarm for each means of activation to ensure that the proper operation of the correct zone of each smoke-

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control system occurs.

3. Check and record proper operation of fans, dampers, and related equipment for each separate zone of each smoke-control system:

    a. Zone in which a smoke-control system automatically activates.
    b. Type of signal that activates smoke-control system, such as sprinkler flow or smoke detector.
    c. Smoke zone(s) where maximum mechanical exhaust to the outside is implemented and no supply air is provided.
    d. Positive-pressure smoke-control zone(s) where maximum air supply is implemented and no exhaust to the outside is provided.
    e. Fan(s) "ON" as required to implement the smoke-control system. Multiple- or variable-speed fans should be further noted to verify that the intended control configuration is achieved.
    f. Fan(s) "OFF" as required to implement the smoke-control system.
    g. Damper(s) "OPEN" or at an adjustable positon where maximum airflow must be achieved.
    h. Damper(s) "CLOSED" where no airflow should take place.
    i. Auxiliary functions to achieve the smoke-control system configuration, such as changes or override of normal operating pressure and temperature-control set points.
    j. If standby power is provided for the smoke-control system, test to verify that the system functions while operating under both normal and standby power.
    k. Check operation in accordance with design indicated.

H. Authority Having Jurisdiction Tests: Conduct additional tests required by authorities having jurisdiction. [**Unless required by authorities having jurisdiction, perform testing without the use of smoke or products that simulate smoke.**]

I. Report: Prepare and submit a complete report of observations, measurements, and deficiencies. Include names and contact information of individuals conducting tests and of individuals witnessing tests.

3.15 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan and equipment with fan(s).
2. Measure and record flows, temperatures, and pressures of each piece of equipment in each hydronic system. Compare the values to design or nameplate information, where information is available.
3. Measure motor voltage and amperage. Compare the values to motor nameplate information.
4. Check the condition of filters.
5. Check the condition of coils.

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6. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. TAB after Construction: Before performing testing and balancing of renovated existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished in accordance with renovation scope indicated by Contract Documents. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. Balance each air outlet.

3.16 TOLERANCES

A. Set HVAC system's airflow rates and water-flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: [**Plus or minus 10 percent**][**Plus 10 percent or minus 5 percent**]<**Insert value**>. If design value is less than 100 cfm, flow rate is within 10 cfm.
2. Air Outlets and Inlets: [**Plus or minus 10 percent**][**Plus 10 percent or minus 5 percent**]<**Insert value**>. If design value is less than 100 cfm, flow rate is within 10 cfm.
3. Heating-Water Flow Rate: [**Plus or minus 5 percent**][**Plus or minus 10 percent**][**Plus 10 percent or minus 5 percent**]<**Insert value**>. If design value is less than 10 gpm, flow rate is within 10 percent.
4. Chilled-Water Flow Rate: [**Plus or minus 5 percent**][**Plus or minus 10 percent**][**Plus 10 percent or minus 5 percent**]<**Insert value**>. If design value is less than 10 gpm, flow rate is within 10 percent.
5. Condenser-Water Flow Rate: [**Plus or minus 5 percent**][**Plus or minus 10 percent**][**Plus 10 percent or minus 5 percent**]<**Insert value**>.

B. Maintaining pressure relationships as designed is to have priority over the tolerances specified above. If the above tolerances change the relative positive or negative airflow from/into the space, tolerances are to be adjusted so as to keep the relative positive cfm or negative cfm from/into the space a constant cfm differential.

END OF SECTION 230593

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SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Related Requirements:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 230719 "HVAC Piping Insulation."
3. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For coatings, indicating VOC content.
4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
5. Product Data: For sealants, indicating VOC content.
6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other

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work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sheet Form Insulation Materials: 12 inches square.
2. Sheet Jacket Materials: 12 inches square.
3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program[, certified by the Department of Labor, Bureau of Apprenticeship and Training].

B. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Ductwork Mockups:

a. One 10-foot section each of rectangular and round straight duct.
b. One each of a 90-degree mitered round and rectangular elbow, and one each of a 90-degree radius round and rectangular elbow.
c. One rectangular branch takeoff and one round branch takeoff from a rectangular duct. One round tee fitting.
d. One rectangular and round transition fitting.
e. Four support hangers for round and rectangular ductwork.
f. Each type of damper and specialty.

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2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. All Insulation Installed Indoors; Outdoors-Installed Insulation in Contact with Airstream: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
3. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

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F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents[, **unless otherwise approved by the engineer-of-record**].

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches][4 inches] o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

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3.2 INSTALLATION OF FLEXIBLE ELASTOMERIC AND POLYOLEFIN INSULATION

A. Comply with manufacturer's written installation instructions and ASTM C1710.

B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Square and Rectangular Ducts and Plenums:

1. Provide 1/4 inch more per side for a tight, compression fit.
2. Cut sheet insulation with the following dimensions:

   a. Width of duct plus 1/4 inch, one piece.
   b. Height of duct plus 1/4 inch, plus thickness of insulation, two pieces.
   c. Width of duct plus 1/4 inch, plus two times the thickness of insulation, one piece.

3. Insulate the bottom of the duct with the sheet from (a) above, then the sides with the two sheets from (b) above, and finally the top of the duct with the sheet from (c) above.
4. Insulation without self-adhering backing:

   a. Apply 100 percent coverage of manufacturer adhesive on the metal surface, then the insulation, except for the last 1/4 inch where sheets will butt together.
   b. Roll sheet down into position.
   c. Press two sheets together under compression and apply adhesive at the butt joint to seal the two sheets together.

5. Insulation with self-adhering backing:

   a. Peel back release paper in 6- to 8-inch increments and line up sheet.
   b. Press firmly to activate adhesive.
   c. Align material and continue to line up correctly, pressing firmly while slowly removing release paper.
   d. Allow 1/4-inch overlap for compression at butt joints.
   e. Apply adhesive at the butt joint to seal the two sheets together.

6. Insulate duct brackets following manufacturer's written installation instructions.

D. Circular Ducts:

1. Determine the circumference of the duct, using a strip of insulation the same thickness as to be used.
2. Cut the sheet to the required size.
3. Apply 100 percent coverage of manufacturer adhesive on the metal surface then the insulation.
4. Apply manufacturer adhesive to the cut surfaces along 100 percent of the longitudinal seam. Press together the seam at the ends and then the middle. Close the entire seam starting from the middle.

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3.3 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

B. Comply with manufacturer's written installation instructions.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for [100][50]<Insert number> percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with

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individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for [100][50]<Insert number> percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

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6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.4 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.5 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Comply with manufacturer's written installation instructions.

B. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

C. Insulate duct access panels and doors to achieve same fire rating as duct.

D. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

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3.6 FIELD QUALITY CONTROL

A. Testing Agency: [Owner will engage][Engage] a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to [one]<Insert number> location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

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3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
4. Polyolefin: [1 inch]<**Insert dimension**> thick.

B. Concealed, round and flat-oval, return-air duct insulation is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
4. Polyolefin: [1 inch]<**Insert dimension**> thick.

C. Concealed, round and flat-oval, outdoor-air duct insulation is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
4. Polyolefin: [1 inch]<**Insert dimension**> thick.

D. Concealed, round and flat-oval, exhaust-air duct insulation is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
4. Polyolefin: [1 inch]<**Insert dimension**> thick.

E. Concealed, rectangular, supply-air duct insulation is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
6. Polyolefin: [1 inch]<**Insert dimension**> thick.

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F. Concealed, rectangular, return-air duct insulation is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
6. Polyolefin: [1 inch]<**Insert dimension**> thick.

G. Concealed, rectangular, outdoor-air duct insulation is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
6. Polyolefin: [1 inch]<**Insert dimension**> thick.

H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<**Insert dimension**> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<**Insert density**> nominal density.
6. Polyolefin: [1 inch]<**Insert dimension**> thick.

I. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated [**blanket**][**or**][**board**]; thickness as required to achieve 2-hour fire rating.

J. Concealed, supply-air plenum insulation is[**one of**] the following:

1. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.

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4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
6. Polyolefin: [1 inch]<Insert dimension> thick.

K. Concealed, return-air plenum insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
6. Polyolefin: [1 inch]<Insert dimension> thick.

L. Concealed, outdoor-air plenum insulation is[one of] the following:

1. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

M. Concealed, exhaust-air plenum insulation is[one of] the following:

1. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

N. Exposed, round and flat-oval, supply-air duct insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Pipe and Tank: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

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5. Mineral Wool Pipe and Tank: [1-1/2 inches][2 inches]<Insert dimension> thick.
6. Polyolefin: [1 inch]<Insert dimension> thick.

O. Exposed, round and flat-oval, return-air duct insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Pipe and Tank: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Pipe and Tank: [1-1/2 inches][2 inches]<Insert dimension> thick.
6. Polyolefin: [1 inch]<Insert dimension> thick.

P. Exposed, round and flat-oval, outdoor-air duct insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Pipe and Tank: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Pipe and Tank: [1-1/2 inches][2 inches]<Insert dimension> thick.
6. Polyolefin: [1 inch]<Insert dimension> thick.

Q. Exposed, round and flat-oval, exhaust-air duct insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Pipe and Tank: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Pipe and Tank: [1-1/2 inches][2 inches]<Insert dimension> thick.
6. Polyolefin: [1 inch]<Insert dimension> thick.

R. Exposed, rectangular, supply-air duct insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4-lb/cu. ft.][6-lb/cu. ft.]<Insert density> nominal density.

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6. Polyolefin: [1 inch]<Insert dimension> thick.

S. Exposed, rectangular, return-air duct insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
6. Polyolefin: [1 inch]<Insert dimension> thick.

T. Exposed, rectangular, outdoor-air duct insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
6. Polyolefin: [1 inch]<Insert dimension> thick.

U. Exposed, rectangular, exhaust-air duct insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
6. Polyolefin: [1 inch]<Insert dimension> thick.

V. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated [blanket][or][board]; thickness as required to achieve 2-hour fire rating.

W. Exposed, supply-air plenum insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.

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4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
6. Polyolefin: [1 inch]<Insert dimension> thick.

X. Exposed, return-air plenum insulation is[one of] the following:

1. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
2. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
3. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
4. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
5. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
6. Polyolefin: [1 inch]<Insert dimension> thick.

Y. Exposed, outdoor-air plenum insulation is[one of] the following:

1. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

Z. Exposed, exhaust-air plenum insulation is[one of] the following:

1. Glass-Fiber Blanket: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

3.9 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Concealed, round and flat-oval, supply-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.

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2. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

C. Concealed, round and flat-oval, return-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

D. Concealed, round and flat-oval, outdoor-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

E. Concealed, rectangular, supply-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

F. Concealed, rectangular, return-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

G. Concealed, supply-air plenum insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

H. Concealed, return-air plenum insulation is[one of] the following:

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1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

I. Exposed, round and flat-oval, supply-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Pipe and Tank: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
3. Mineral Wool Blanket: [1-1/2 inches][2 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Pipe and Tank: [1-1/2 inches][2 inches]<Insert dimension> thick.

J. Exposed, round and flat-oval, return-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

K. Exposed, rectangular, supply-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

L. Exposed, rectangular, return-air duct insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu.

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ft.][6 lb/cu. ft.]<Insert density> nominal density.

M. Exposed, supply-air plenum insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

N. Exposed, return-air plenum insulation is[one of] the following:

1. Glass-Fiber Blanket: [2 inches][3 inches]<Insert dimension> and [0.75 lb/cu. ft.][1.5 lb/cu. ft.][3 lb/cu. ft.] nominal density.
2. Glass-Fiber Board: [2 inches][3 inches]<Insert dimension> thick and [2 lb/cu. ft.][3 lb/cu. ft.][6 lb/cu. ft.] nominal density.
3. Mineral Wool Blanket: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.
4. Mineral Wool Board: [2 inches][3 inches]<Insert dimension> thick and [4 lb/cu. ft.][6 lb/cu. ft.]<Insert density> nominal density.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.
2. [PVC][PVC, Color-Coded by System]: [20 mils][30 mils] thick.
3. Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [Type 304][or][Type 316], [Smooth 2B Finish][Corrugated][Stucco Embossed]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <Insert jacket type>.

D. Ducts and Plenums, Exposed:

1. None.
2. [PVC][PVC, Color-Coded by System]: [20 mils][30 mils] thick.
3. Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020

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inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [Type 304][or][Type 316], [Smooth 2B Finish][Corrugated][Stucco Embossed]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <Insert jacket type>.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.
2. [PVC][PVC, Color-Coded by System]: [20 mils][30 mils] thick.
3. Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [Type 304][or][Type 316], [Smooth 2B Finish][Corrugated][Stucco Embossed]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <Insert jacket type>.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
2. Painted Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
3. Stainless Steel, [Type 304][or][Type 316], [Smooth 2B Finish][Corrugated][Stucco Embossed]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
4. <Insert jacket type>.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. [Painted]Aluminum, [Smooth][Stucco Embossed] with [1-1/4-Inch- Deep Corrugations][2-1/2-Inch- Deep Corrugations][4-by-1-Inch Box Ribs]: [0.032 inch][0.040 inch] thick.
2. Stainless Steel, [Type 304][or][Type 316], [Smooth][Stucco Embossed], with [1-1/4-Inch- Deep Corrugations][2-1/2-Inch- Deep Corrugations][4-by-1-Inch Box Ribs]: [0.020 inch][0.024 inch] thick.
3. <Insert jacket type>.

END OF SECTION 230713

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SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.

B. Related Requirements:

1. Section 230713 "Duct Insulation" for duct insulation.
2. Section 230716 "HVAC Equipment Insulation" for equipment insulation.
3. Section 232113.13 "Underground Hydronic Piping" loose-fill pipe insulation in underground piping outside the building.
4. Section 232213.13 "Underground Steam and Condensate Heating Piping" for steam and condensate piping for steam-type tank heaters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

B. Sustainable Design Submittals:

1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
2. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Sheet Form Insulation Materials: 12 inches square.
3. Jacket Materials for Pipe: 12 inches long by NPS 2.

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4. Sheet Jacket Materials: 12 inches square.
5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program[, certified by the Department of Labor, Bureau of Apprenticeship and Training].

B. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

    a. One 10-foot section of NPS 2 straight pipe.
    b. One each of a 90-degree threaded, welded, and flanged elbow.
    c. One each of a threaded, welded, and flanged tee fitting.
    d. One NPS 2 or smaller valve and one NPS 2-1/2 or larger valve.
    e. Four support hangers, including hanger shield and insert.
    f. One threaded strainer and one flanged strainer with removable portion of insulation.
    g. One threaded reducer and one welded reducer.
    h. One pressure temperature tap.
    i. One mechanical coupling.
    j. One union.
    k. <Insert mockup>.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect [seven]<Insert number> days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

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6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authority having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. All Insulation Installed Indoors; Outdoors-Installed Insulation in Contact with Airstream: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
3. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace

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insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents[, **unless otherwise approved by the engineer of record**].

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at [2 inches][4 inches] o.c.
4. For below-ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least [4 inches]<**Insert value**> beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

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P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.2 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using [**prefabricated fitting insulation**][or][**mitered or routed fittings**] made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with [**prefabricated fitting insulation**][or][**sectional pipe insulation**] of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using [**prefabricated fitting insulation**][or][**sectional pipe insulation**] of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using [**prefabricated fitting insulation**][or][**sectional pipe insulation**] of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing

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mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers[**at locations indicated**]. Installation conforms to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.3 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

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B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When prefabricated insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install pipe insulation, quads, hex sections, or beveled lag segments, adhered together, of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.4 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

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3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

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1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.

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3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets with vapor retarder on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated insulation sections, or mitered or routed fittings, of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation

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without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYISOCYANURATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic.
3. All insulation is tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, and same thickness as that of adjacent pipe insulation, not to exceed 1-1/2-inch thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.

C. Insulation Installation on Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of polyisocyanurate insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive [**,or via self-seal mechanism**] to eliminate openings in insulation that allow passage of air to surface being insulated.

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B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.10 INSTALLATION OF POLYSTYRENE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic.
3. All insulation is tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, and make thickness same as that of adjacent pipe insulation, not to exceed 1-1/2 inches.
3. Fill voids between inner circumference of flange insulation and outer

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circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness that of as pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated section of polystyrene insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.11 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections[**with the assistance of a factory-authorized service representative**].

E. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to [**three**]<**Insert number**> locations of straight pipe, [**three**]<**Insert number**> locations of threaded fittings, [**three**]<**Insert number**> locations of welded fittings, [**two**]<**Insert number**> locations of threaded strainers, [**two**]<**Insert number**> locations of welded strainers, [**three**]<**Insert number**> locations of threaded valves, and [**three**]<**Insert number**> locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

F. All insulation applications will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more

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stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [3/4 inch][1 inch]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1/2 inch][1 inch]<**Insert dimension**> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1/2 inch][1 inch]<**Insert dimension**> thick.
e. Phenolic: [1 inch]<**Insert dimension**> thick.
f. Polyisocyanurate: [1 inch]<**Insert dimension**> thick.
g. Polyolefin: [3/4 inch][1 inch]<**Insert dimension**> thick.

B. Chilled Water and Brine, 40 Deg F and below:

1. [NPS 3]<**Insert pipe size**> and Smaller: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches][2 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
e. Phenolic: [1 inch][1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick.
f. Polyisocyanurate: [1 inch]<**Insert dimension**> thick.
g. Polyolefin: [1 inch]<**Insert dimension**> thick.

2. [NPS 4 to NPS 12]<**Insert pipe size range**>: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1-1/2 inches][2inches]<**Insert dimension**> thick.

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d. Mineral Wool, Preformed Pipe Insulation, Type-II: [1-1/2 inches][2inches]<**Insert dimension**> thick.
e. Phenolic: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick.
f. Polyisocyanurate: [1 inch]<**Insert dimension**> thick.

3. [NPS 14]<**Insert pipe size**> and Larger: Insulation is[**one of**] the following:

a. Cellular Glass: [2 inches][3 inches]<**Insert dimension**> thick.
b. Glass-Fiber, [**Preformed Pipe Insulation, Type I,**][or][**Pipe and Tank Insulation**]: [2 inches][3 inches]<**Insert dimension**> thick.
c. Mineral Wool, [**Preformed Pipe Insulation, Type II,**][or][**Pipe and Tank Insulation**]: [2 inches][3 inches]<**Insert dimension**> thick.
d. Phenolic: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick.

C. Chilled Water and Brine, Above 40 Deg F:

1. [NPS 12]<**Insert pipe size**> and Smaller: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches][2 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
e. Phenolic: [1 inch][1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick.
f. Polyisocyanurate: [1 inch]<**Insert dimension**> thick.
g. Polyolefin: [1 inch]<**Insert dimension**> thick.

2. [NPS 14]<**Insert pipe size**> and Larger: Insulation is[**one of**] the following:

a. Cellular Glass: [2 inches][3 inches]<**Insert dimension**> thick.
b. Glass-Fiber [**Preformed Pipe Insulation, Type I,**][or][**Pipe and Tank Insulation**]: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick.
c. Mineral Wool: [**Preformed Pipe Insulation, Type II**][or][**Pipe and Tank Insulation**]: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick.
d. Phenolic: [1-1/2 inches][2 inches][3 inches]<**Insert dimension**> thick.

D. Condenser-Water Supply and Return:

1. [NPS 12]<**Insert pipe size**> and Smaller: Insulation is[**one of**] the following:

a. Cellular Glass: [1-1/2 inches][2 inches]<**Insert dimension**> thick.
b. Flexible Elastomeric: [1 inch]<**Insert dimension**> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
e. Phenolic: [1 inch][1-1/2 inches]<**Insert dimension**> thick.
f. Polyisocyanurate: [1 inch]<**Insert dimension**> thick.
g. Polyolefin: [1 inch]<**Insert dimension**> thick.

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2. [NPS 14]<Insert pipe size> and Larger: Insulation is[one of] the following:

   a. Cellular Glass: [2 inches][3 inches]<Insert dimension> thick.
   b. Glass-Fiber, [Preformed Pipe Insulation, Type I][or][Pipe and Tank Insulation]: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
   c. Mineral Wool, [Preformed Pipe Insulation, Type II][or][Pipe and Tank Insulation]: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
   d. Phenolic: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.

E. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. [NPS 12]<Insert pipe size> and Smaller: Insulation is[one of] the following:

   a. Cellular Glass: [1-1/2 inches][2 inches]<Insert dimension> thick.
   b. Glass-Fiber, Preformed Pipe, Type I: [1 inch][2 inches]<Insert dimension> thick.
   c. Mineral Wool, Preformed Pipe, Type II: [1 inch][2 inches]<Insert dimension> thick.
   d. Phenolic: [1 inch][1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
   e. Polyisocyanurate: [1 inch]<Insert dimension> thick.

2. [NPS 14]<Insert pipe size> and Larger: Insulation is[one of] the following:

   a. Cellular Glass: [2 inches][3 inches]<Insert dimension> thick.
   b. Glass-Fiber, [Preformed Pipe Insulation, Type I][or][Pipe and Tank Insulation]: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
   c. Mineral Wool, [Preformed Pipe Insuation, Type II][or][Pipe and Tank Insulation]: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
   d. Phenolic: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.

F. Heating-Hot-Water Supply and Return, Above 200 Deg F:

1. [NPS 3/4]<Insert pipe size> and Smaller: Insulation is[one of] the following:

   a. Calcium Silicate: [2 inches][3 inches]<Insert dimension> thick.
   b. Cellular Glass: [2 inches][3 inches]<Insert dimension> thick.
   c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1-1/2 inches][2 inches]<Insert dimension> thick.
   d. Mineral Wool, Preformed Pipe Insulation, Type II: [1-1/2 inches][2 inches]<Insert dimension> thick.

2. [NPS 1]<Insert pipe size> and Larger: Insulation is[one of] the following:

   a. Calcium Silicate: [3 inches][4 inches]<Insert dimension> thick.
   b. Cellular Glass: [3 inches][4 inches]<Insert dimension> thick.
   c. Glass-Fiber, Preformed Pipe, Type I: [3 inches][4 inches]<Insert dimension> thick.
   d. Mineral Wool, Preformed Pipe, Type II: [3 inches][4 inches]<Insert dimension> thick.

G. Steam and Steam Condensate, Boiler Blowdown, Vents, Drains[, and Safety Relief

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Vents] 350 Deg F and Below:

1. [NPS 3/4]<Insert pipe size> and Smaller: Insulation is[one of] the following:

   a. Calcium Silicate: [2 inches][3 inches]<Insert dimension> thick.
   b. Cellular Glass: [2 inches][3 inches]<Insert dimension> thick.
   c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1-1/2 inches][2 inches]<Insert dimension> thick.
   d. Mineral Wool, Preformed Pipe Insulation, Type II: [1-1/2 inches][2 inches]<Insert dimension> thick.

2. [NPS 1]<Insert pipe size> and Larger: Insulation is[one of] the following:

   a. Calcium Silicate: [3 inches][4 inches]<Insert dimension> thick.
   b. Cellular Glass: [3 inches][4 inches]<Insert dimension> thick.
   c. Glass-Fiber, [Preformed Pipe Insulation, Type I][or][Pipe and Tank Insulation]: [3 inches][4 inches]<Insert dimension> thick.
   d. Mineral Wool, [Preformed Pipe Insulation, Type II][or][Pipe and Tank Insulation]: [3 inches][4 inches]<Insert dimension> thick.

H. Steam and Steam Condensate, Boiler Blowdown, Vents, Drains[, and Safety Relief Vents] Above 350 Deg F:

1. [NPS 3/4]<Insert pipe size> and Smaller: Insulation is[one of] the following:

   a. Calcium Silicate: [2 inches][3 inches]<Insert dimension> thick.
   b. Cellular Glass: [2 inches][3 inches]<Insert dimension> thick.
   c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1-1/2 inches][2 inches]<Insert dimension> thick.
   d. Mineral Wool, Preformed Pipe Insulation, Type II: [1-1/2 inches][2 inches]<Insert dimension> thick.

2. [NPS 1]<Insert pipe size> and Larger: Insulation is[one of] the following:

   a. Calcium Silicate: [3 inches][4 inches]<Insert dimension> thick.
   b. Cellular Glass: [3 inches][4 inches]<Insert dimension> thick.
   c. Glass-Fiber, [Preformed Pipe Insulation, Type I][or][Pipe and Tank Insulation]: [3 inches][4 inches]<Insert dimension> thick.
   d. Mineral Wool, [Preformed Pipe Insulation, Type II][or][Pipe and Tank Insulation]: [3 inches][4 inches]<Insert dimension> thick.

I. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation is[one of] the following:

   a. Cellular Glass: [1-1/2 inches]<Insert dimension> thick.
   b. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
   c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<Insert dimension> thick.
   d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<Insert dimension> thick.

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e. Phenolic: [1 inch]<Insert dimension> thick.
f. Polyisocyanurate: [1 inch]<Insert dimension> thick.
g. Polyolefin: [1 inch]<Insert dimension> thick.

J. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Flexible Elastomeric: [2 inches]<Insert dimension> thick.
b. Polyolefin: [2 inches]<Insert dimension> thick.

K. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [1-1/2 inches]<Insert dimension> thick.
b. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [1 inch]<Insert dimension> thick.
e. Phenolic: [1 inch]<Insert dimension> thick.
f. Polyisocyanurate: [1 inch]<Insert dimension> thick.
g. Polyolefin: [1 inch]<Insert dimension> thick.

L. Dual-Service Heating and Cooling, 40 to 200 Deg F:

1. [NPS 12]<Insert pipe size> and Smaller: Insulation is[one of] the following:

a. Cellular Glass: [1-1/2 inches][2 inches]<Insert dimension> thick.
b. Flexible Elastomeric: [1 inch][1-1/2 inches][2 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [1 inch][1-1/2 inches][2 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type I: [1 inch][1-1/2 inches][2 inches]<Insert dimension> thick.
e. Phenolic: [1 inch][1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
f. Polyisocyanurate: [1 inch]<Insert dimension> thick.

2. [NPS 14]<Insert pipe size> and Larger: Insulation is[one of] the following:

a. Cellular Glass: [2 inches][3 inches]<Insert dimension> thick.
b. Mineral-Fiber, [Preformed Pipe Insulation, Type I][or][Pipe and Tank Insulation]: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.
c. Phenolic: [1-1/2 inches][2 inches][3 inches]<Insert dimension> thick.

M. Heat-Recovery Piping:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [1-1/2 inches]<Insert dimension> thick.

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b. Flexible Elastomeric: [1 inch]<Insert dimension> thick.
c. Glass-Fiber, [Preformed Pipe Insulation, Type I][or][Pipe and Tank Insulation]: [1 inch]<Insert dimension> thick.
d. Mineral Wool, [Preformed Pipe Insulation, Type II][or][Pipe and Tank Insulation]: [1 inch]<Insert dimension> thick.
e. Phenolic: [1 inch]<Insert dimension> thick.
f. Polyisocyanurate: [1 inch]<Insert dimension> thick.
g. Polyolefin: [1 inch]<Insert dimension> thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water and Brine:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [3 inches]<Insert dimension> thick.
b. Flexible Elastomeric: [3 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [3 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [3 inches]<Insert dimension> thick.
e. Phenolic: [2 inches]<Insert dimension> thick.
f. Polyisocyanurate: [2 inches]<Insert dimension> thick.
g. Polystyrene: [2 inches]<Insert dimension> thick.

B. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [2 inches]<Insert dimension> thick.
b. Flexible Elastomeric: [2 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.
e. Phenolic: [2 inches]<Insert dimension> thick.
f. Polyisocyanurate: [2 inches]<Insert dimension> thick.
g. Polystyrene: [2 inches]<Insert dimension> thick.

C. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [3 inches]<Insert dimension> thick.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
c. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.
d. Phenolic: [2 inches]<Insert dimension> thick.
e. Polyisocyanurate: [2 inches]<Insert dimension> thick.

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D. Heating-Hot-Water Supply and Return, Above 200 Deg F:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Calcium Silicate: [3 inches]<Insert dimension> thick.
b. Cellular Glass: [3 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.

E. Steam and Steam Condensate[, and Safety Relief Vents], 350 Deg F and Below:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Calcium Silicate: [4 inches]<Insert dimension> thick.
b. Cellular Glass: [4 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [3 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [3 inches]<Insert dimension> thick.

F. Steam and Steam Condensate[, and Safety Relief Vents], Above 350 Deg F:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Calcium Silicate: [5 inches]<Insert dimension> thick.
b. Cellular Glass: [5 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [4 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [4 inches]<Insert dimension> thick.

G. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [2 inches]<Insert dimension> thick.
b. Flexible Elastomeric: [2 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.
e. Phenolic: [2 inches]<Insert dimension> thick.
f. Polyisocyanurate: [2 inches]<Insert dimension> thick.
g. Polystyrene: [2 inches]<Insert dimension> thick.

H. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation is the following:

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a. Flexible Elastomeric: [2 inches]<Insert dimension> thick.

I. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Flexible Elastomeric: [1 inch][2 inches]<Insert dimension> thick.
b. Polyolefin: [1 inch]<Insert dimension> thick.

J. Heat-Recovery Piping:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [2 inches]<Insert dimension> thick.
b. Flexible Elastomeric: [2 inches]<Insert dimension> thick.
c. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
d. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.
e. Phenolic: [2 inches]<Insert dimension> thick.
f. Polyisocyanurate: [2 inches]<Insert dimension> thick.
g. Polystyrene: [2 inches]<Insert dimension> thick.

K. Dual-Service Heating and Cooling:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [3 inches]<Insert dimension> thick.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
c. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.
d. Phenolic: [2 inches]<Insert dimension> thick.
e. Polyisocyanurate: [2 inches]<Insert dimension> thick.

L. Fuel Oil Piping, Heated:

1. All Pipe Sizes: Insulation is[one of] the following:

a. Cellular Glass: [2 inches]<Insert dimension> thick.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: [2 inches]<Insert dimension> thick.
c. Mineral Wool, Preformed Pipe Insulation, Type II: [2 inches]<Insert dimension> thick.

3.15 OUTDOOR, UNDERGROUND, PIPING INSULATION SCHEDULE

A. Insulation for belowground piping is specified in Section 232113.13 "Underground Hydronic Piping" and Section 232213.13 "Underground Steam and Condensate Heating Piping."

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B. Chilled Water, All Sizes: Cellular glass, [2 inches]<Insert dimension> thick.

C. Condenser-Water Supply and Return, All Sizes: Cellular glass, [2 inches]<Insert dimension> thick.

D. Heating-Hot-Water Supply and Return, All Sizes, 200 Deg F and Below: Cellular glass, [3 inches]<Insert dimension> thick.

E. Heating-Hot-Water Supply and Return, All Sizes, Above 200 Deg F:

1. Calcium Silicate: [3 inches]<Insert dimension> thick.
2. Cellular Glass: [3 inches]<Insert dimension> thick.

F. Steam and Steam Condensate, All Sizes, 350 Deg F and Below:

1. Calcium Silicate: [4 inches]<Insert dimension> thick.
2. Cellular Glass: [4 inches]<Insert dimension> thick.

G. Steam and Steam Condensate, All Sizes, Above 350 Deg F:

1. Calcium Silicate: [5 inches]<Insert dimension> thick.
2. Cellular Glass: [5 inches]<Insert dimension> thick.

H. Dual-Service Heating and Cooling, All Sizes, 40 to 200 Deg F: Cellular glass, [3 inches]<Insert dimension> thick.

I. Fuel Oil Piping, All Sizes, Heated: Cellular glass, [2 inches]<Insert dimension> thick.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. [PVC][PVC, Color-Coded by System]: [20 mils][30 mils] thick.
3. Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [Type 304][or][Type 316], [Smooth No. 2B Finish][Corrugated][Stucco Embossed]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <Insert jacket type>.

D. Piping, Exposed:

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1. None.
2. [PVC][PVC, Color-Coded by System]: [20 mils][30 mils] thick.
3. Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [Type 304][or][Type 316], [Smooth No. 2B Finish][Corrugated][Stucco Embossed]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <Insert jacket type>.

3.17 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. [PVC][PVC, Color-Coded by System]: [20 mils][30 mils] thick.
3. Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
4. Painted Aluminum, [Smooth][Corrugated][Stucco Embossed]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch] thick.
5. Stainless Steel, [Type 304][Type 316][Type 304][or][Type 316], [Smooth No. 2B Finish][Corrugated][Stucco Embossed]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
6. <Insert jacket type>.

D. Piping, Exposed:

1. PVC: [20 mils][30 mils][40 mils] thick.
2. [Painted]Aluminum, [Smooth][Corrugated][Stucco Embossed][with Z-Shaped Locking Seam]: [0.016 inch][0.020 inch][0.024 inch][0.032 inch][0.040 inch] thick.
3. Stainless Steel, [Type 304][Type 316][Type 304][or][Type 316], [Smooth No. 2B Finish][Corrugated][Stucco Embossed][with Z-Shaped Locking Seam]: [0.010 inch][0.016 inch][0.020 inch][0.024 inch] thick.
4. <Insert jacket type>.

END OF SECTION 230719

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SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiberglass pipe and fittings.
2. Piping joining materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show hydronic piping layouts, sizes and elevations, including connecting equipment, valves, specialty valves, fittings, strainers, air vents, expansion tanks, air/dirt separators/purgers, meters, expansion loops/expansion joints/anchors, and low point drains.
2. Show interface and spatial relationships between piping and equipment.
3. Shop Drawing Scale: [1/4 inch equals 1 foot]<Insert value>.

C. Delegated Design Submittals:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors, alignment guides, and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

D. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Environmental Product Declaration (EPD): For each product.
3. Environmental Product Declaration (EPD): For each product.
4. Third-Party Certifications: For each product.
5. Third-Party-Certified Life-Cycle Assessment: For each product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, indicating the

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items described in this Section, and coordinated with all building trades.

B. Qualification Data: For Installer.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers are to be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
2. Fiberglass Pipe and Fitting Installers: Installers of RTRF and RTRP are to be certified by manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.

B. Steel Support Welding: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

C. Pipe Welding: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9 for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.5 WARRANTY

A. PP-R and PP-RCT Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R and PP-RCT pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
2. Warranty is to be in effect only upon submission by Contractor to manufacturer of valid pressure/leak documentation indicating that the system was tested and passed manufacturer's pressure/leak test and any other manufacturer requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation are to be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:

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1. Hot-Water Heating Piping: [100 psig]<Insert psig> at [200 deg F][180 deg F]<Insert temperature>.
2. Chilled-Water Piping: [150 psig]<Insert psig> at [73 deg F]<Insert temperature>.
3. Dual-Temperature Heating- and Cooling-Water Piping: [100 psig]<Insert psig> at [180 deg F]<Insert temperature>.
4. Condenser-Water Piping: [150 psig]<Insert psig> at [73 deg F]<Insert temperature>.
5. Glycol Cooling-Water Piping: [150 psig]<Insert psig> at [150 deg F]<Insert temperature>.
6. Makeup-Water Piping: [80 psig][150 psig]<Insert value> at [73 deg F][150 deg F]<Insert temperature>.
7. Condensate-Drain Piping: [150 deg F][180 deg F]<Insert temperature>.
8. Air-Vent Piping: [180 deg F][200 deg F]<Insert temperature>.
9. Pressure-Relief-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

D. Solder Filler Metals: ASTM B32, lead-free alloys.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Flux: ASTM B813, water flushable.

G. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for CPVC Piping: ASTM F493.

1. Product Data: Verify CPVC welding solvent cement has a VOC content of 490 g/L or less.
2. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9

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mcg/cu. m or 7 ppb, whichever is less.

I. Solvent Cements for PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.

1. Product Data:

a. Verify PVC welding solvent cement has a VOC content of 510 g/L or less.
b. Verify adhesive primer has a VOC content of 550 g/L or less.

2. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
3. Product Data: Verify adhesive primer complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

J. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

1. Verify fiberglass adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
2. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-Water Heating Piping, Aboveground, NPS 2 (DN 50) and Smaller, to Be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**pressure-seal**][**grooved mechanical**][**mechanically formed tee**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe; [**Class 125, cast-iron**][**Class 150, malleable-iron**][**Class 250, cast-iron**][**Class 300, malleable-iron**] fittings; and [**threaded**][**grooved mechanical**] joints.
3. Schedule 5, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 316**]<**Insert type**>, stainless steel pressure-seal fittings; and pressure-seal joints.
4. [**Schedule 10**][**Schedule 40**]<**Insert schedule number**>, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 304**]<**Insert type**>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.

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5. [**Schedule 40**]<**Insert schedule number**>, CPVC plastic pipe and fittings and solvent-welded joints.
6. RTRP and RTRF with adhesive joints.

B. Hot-Water Heating Piping, Aboveground, NPS 2-1/2 (DN 65) and Larger, to Be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**grooved mechanical**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe; [**Class 125, cast-iron**][**Class 150, malleable-iron**][**Class 250 cast-iron**][**Class 300 malleable-iron**] fittings; welded joints, cast-iron flanges, flange-fittings, and flanged joints.
3. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe; grooved mechanical joint coupling and fittings; and grooved mechanical joints.
4. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe, plain-end mechanical joint couplings and fittings; and plain-end mechanical joints.
5. [**Schedule 10**][**Schedule 40**]<**Insert schedule number**>, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 304**]<**Insert type**>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
6. [**Schedule 40**]<**Insert schedule number**>, CPVC plastic pipe and fittings and solvent-welded joints.
7. RTRP and RTRF with adhesive or flanged joints.

C. Chilled-Water Piping, Aboveground, NPS 2 (DN 50) and Smaller, to be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**pressure-seal**][**grooved mechanical**][**mechanically formed tee**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, Grade B steel pipe; [**Class 125, cast-iron**][**Class 150, malleable-iron**][**Class 250, cast-iron**][**Class 300, malleable-iron**] fittings; and [**threaded**][**grooved mechanical**] joints.
3. Schedule 5, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 316**]<**Insert type**>, stainless steel pressure-seal fittings; and pressure-seal joints.
4. [**Schedule 10**][**Schedule 40**]<**Insert schedule number**>, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 304**]<**Insert type**>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
5. [**Schedule 40**]<**Insert schedule number**>, CPVC plastic pipe and fittings and solvent-welded joints.
6. [**PP-R**][**PP-RCP**] plastic piping and fittings with heat fusion joints.
7. RTRP and RTRF with adhesive or flanged joints.

D. Chilled-Water Piping, Aboveground, NPS 2-1/2 (DN 65) and Larger, to Be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**grooved mechanical**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

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3. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe; grooved mechanical joint coupling and fittings; and grooved mechanical joints.
4. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe, plain-end mechanical joint coupling and fittings; and plain-end mechanical joints.
5. [**Schedule 10**][**Schedule 40**]<**Insert schedule number**>, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 304**]<**Insert type**>, grooved mechanical joint coupling and fittings; and grooved, mechanical joints.
6. [**Schedule 40**]<**Insert schedule number**>, CPVC plastic pipe and fittings and solvent-welded joints.
7. RTRP and RTRF with adhesive or flanged joints.
8. [**PP-R**][**PP-RCP**] plastic piping and fittings with heat fusion joints.

E. Dual-Temperature Heating- and Cooling-Water Piping, Aboveground, NPS 2 (DN 50) and Smaller, to Be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**pressure-seal**][**grooved mechanical**][**mechanically formed tee**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, Grade B steel pipe; [**Class 125, cast-iron**][**Class 150, malleable-iron**][**Class 250, cast-iron**][**Class 300, malleable-iron**] fittings; and [**threaded**][**grooved mechanical**] joints.
3. Schedule 5, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 316**]<**Insert Type**> stainless steel pressure-seal couplings and fittings; and pressure-seal joints.
4. [**Schedule 10**][**Schedule 40**]<**Insert schedule number**>, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 304**]<**Insert type**>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
5. [**Schedule 40**]<**Insert schedule number**>, CPVC plastic pipe and fittings and solvent-welded joints.
6. [**PP-R**][**PP-RCP**] plastic piping and fittings with heat fusion joints.
7. RTRP and RTRF with adhesive or flanged joints.

F. Dual-Temperature Heating and Cooling-Water Piping, Aboveground, NPS 2-1/2 (DN 65) and Larger, to Be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**grooved mechanical**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, Grade B steel pipe, [**Class 125, cast-iron**][**Class 150, malleable-iron**][**Class 250 cast-iron**][**Class 300 malleable-iron**] fittings; welded joints, cast-iron flanges and flange-fittings; and flanged joints.
3. [**Schedule 40**]<**Insert schedule number**>, Grade B steel pipe; grooved mechanical joint coupling and fittings; and grooved mechanical joints.
4. [**Schedule 40**]<**Insert schedule number**>, steel pipe, plain-end mechanical joint couplings and fittings; and plain-end mechanical joints.
5. [**Schedule 10**][**Schedule 40**]<**Insert schedule number**>, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 304**]<**Insert type**>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
6. [**Schedule 40**]<**Insert schedule number**>, CPVC plastic pipe and fittings and solvent-welded joints.
7. RTRP and RTRF with adhesive or flanged joints.

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G. Condenser-Water Piping, Aboveground, NPS 2 (DN 50) and Smaller, to Be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**pressure-seal**][**grooved mechanical**][**mechanically formed tee**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe; [**Class 125, cast-iron**][**Class 150, malleable-iron**][**Class 250 cast-iron**][**Class 300 malleable-iron**], fittings; and [**threaded**][**grooved mechanical**] joints.
3. Schedule 5, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 316**]<**Insert type**>, stainless steel pressure-seal couplings and fittings; and pressure-seal joints.
4. [**Schedule 10**][**Schedule 40**]<**Insert schedule number**>, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 304**]<**Insert type**>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
5. [**Schedule 40**]<**Insert schedule number**>, CPVC plastic pipe and fittings and solvent-welded joints.
6. [**PP-R**][**PP-RCP**] plastic piping and fittings with heat fusion joints.
7. RTRP and RTRF with adhesive joints.

H. Condenser-Water Piping, Aboveground, NPS 2-1/2 (DN 65) and Larger, to Be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**grooved mechanical**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe, [**Class 125, cast-iron**][**Class 150, malleable-iron**][**Class 250 cast-iron**][**Class 300 malleable-iron**] fittings; welded joints, cast-iron flanges and flange-fittings; and flanged joints.
3. [**Schedule 40**]<**Insert schedule number**>, Grade B, steel pipe; grooved, mechanical joint coupling and fittings; and grooved mechanical joints.
4. [**Schedule 40**]<**Insert schedule number**>, steel pipe, plain-end mechanical joint coupling and fittings; and plain-end mechanical joints.
5. [**Schedule 10**][**Schedule 40**]<**Insert schedule number**>, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 304**]<**Insert type**>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
6. [**Schedule 40**]<**Insert schedule number**>, CPVC plastic pipe and fittings and solvent-welded joints.
7. RTRP and RTRF with adhesive or flanged joints.
8. [**PP-R**][**PP-RCP**] piping and fittings with heat fusion joints.

I. Glycol Cooling-Water Piping, Aboveground, NPS 2 (DN 50) and Smaller, to Be Any of the Following:

1. [Type K][Type L]<**Insert type**>, drawn-temper copper tubing, wrought-copper fittings, and [**soldered**][**brazed**][**pressure-seal**][**grooved mechanical**][**mechanically formed tee**] joints.
2. [**Schedule 40**]<**Insert schedule number**>, steel pipe; [**Class 125, cast-iron**][**Class 150, malleable-iron**][**Class 250, cast-iron**][**Class 300, malleable-iron**] fittings; and threaded joints.
3. Schedule 5, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 316**]<**Insert**

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type>, stainless steel pressure-seal couplings and fittings; and pressure-seal joints.

4. [Schedule 10][Schedule 40]<Insert schedule number>, [Type 304]<Insert type>, stainless steel pipe; [Type 304]<Insert type>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
5. [Schedule 40]<Insert schedule number>, CPVC plastic pipe and fittings and solvent-welded joints.
6. [PP-R][PP-RCP] plastic piping and fittings with heat fusion joints.
7. RTRP and RTRF with adhesive or flanged joints.

J. Glycol Cooling-Water Piping, Aboveground, NPS 2-1/2 (DN 65) and Larger, to Be Any of the Following:

1. [Type K][Type L]<Insert type>, drawn-temper copper tubing, wrought-copper fittings, and [soldered][brazed][grooved mechanical] joints.
2. [Schedule 40]<Insert schedule number>, Grade B, steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
3. [Schedule 40]<Insert schedule number>, Grade B, steel pipe; grooved, mechanical joint coupling and fittings; and grooved mechanical joints.
4. [Schedule 40]<Insert schedule number>, Grade B, steel pipe, plain-end mechanical joint coupling and fittings; and plain-end mechanical joints.
5. [Schedule 10][Schedule 40]<Insert schedule number>, [Type 304]<Insert type>, stainless steel pipe; [Type 304]<Insert type>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
6. [Schedule 40]<Insert schedule number>, CPVC plastic pipe and fittings and solvent-welded joints.
7. RTRP and RTRF with adhesive or flanged joints.
8. [PP-R][PP-RCP] plastic piping and fittings with heat fusion joints.

K. Makeup-Water Piping Installed Aboveground to Be Any of the Following:

1. [Type K][Type L]<Insert type>, drawn-temper copper tubing, wrought-copper fittings, and [soldered][brazed][pressure-seal][mechanical grooved][mechanically formed tee] joints.
2. [Schedule 40]<Insert schedule number>, CPVC plastic pipe and fittings, and solvent-welded joints.
3. Schedule 5, [Type 304]<Insert type>, stainless steel pipe; [Type 316]<Insert type>, stainless steel pressure-seal couplings and fittings; and pressure-seal joints.
4. [Schedule 10][Schedule 40]<Insert schedule number>, [Type 304]<Insert type>, stainless steel pipe; [Type 304]<Insert type>, grooved mechanical joint coupling and fittings; and grooved mechanical joints.
5. [PP-R][PP-RCP] plastic piping and fittings with heat fusion joints.
6. RTRP and RTRF with adhesive joints.

L. Condensate-Drain Piping Installed Aboveground to Be Any of the Following:

1. [Type K][Type L][Type DWV]<Insert type>, drawn-temper copper tubing, wrought-copper fittings, and [soldered][brazed][pressure-seal][grooved

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mechanical][**mechanically formed tee**] joints.

2. [**Schedule 40**]<**Insert schedule number**>, PVC plastic pipe and fittings and solvent-welded joints.
3. Schedule 5, [**Type 304**]<**Insert type**>, stainless steel pipe; [**Type 316**]<**Insert type**>, stainless steel pressure-seal couplings and fittings; and pressure-seal joints.
4. [**PP-R**][**PP-RCP**] plastic piping and fittings with heat fusion joints.

M. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems, in accordance with piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

N. Pressure-Relief-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed, with metal-to-plastic transition fittings for plastic piping systems, in accordance with piping manufacturer's written instructions.

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

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K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using[**mechanically formed**] tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves in accordance with Section 230523 "General-Duty Valves for HVAC Piping."

Q. Install air vents and pressure-relief valves in accordance with Section 232116 "Hydronic Piping Specialties."

R. Install unions in piping, [NPS 2]<**Insert pipe size**> and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

S. Install flanges in piping, [NPS 2-1/2]<**Insert pipe size**> and larger, at final connections of equipment and elsewhere as indicated.

T. Install shutoff valve immediately upstream of each dielectric fitting.

U. Comply with requirements in Section 230500 "Common Work Results for HVAC" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.

V. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 230548

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"Vibration and Seismic Controls for HVAC."

B. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

C. Install hangers for [**copper tubing**][**and**][**steel piping**], with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for plastic piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Install hangers for fiberglass piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support horizontal piping within [12 inches]<**Insert dimension**> of each fitting and coupling.

G. Support vertical runs of [**copper tubing**][**and**][**steel piping**] to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

H. Support vertical runs of [**CPVC**][**PVC**][**PP-R**][**and**][**PP-RCP**] piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

I. Support vertical runs of fiberglass piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.4 SYSTEM STARTUP

A. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

3.5 FIELD QUALITY CONTROL

A. Prepare hydronic piping in accordance with ASME B31.9 and as follows:

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1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure is to be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install pressure-relief valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient-temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure is not to exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9.
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

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SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Submit data for each type of refrigerant piping, fitting, valve, piping specialty, and refrigerant.

B. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, at a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.
3. Shop Drawing Scale: [1/4 inch equals 1 ft.]<Insert value>.

C. Delegated Design Submittal: For refrigerant piping design, including sizing and layout, oil traps, double risers, specialties, and pipe and tube sizes to accommodate, at a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

D. Sustainable Design Submittals:

1. Product Data: For refrigerants, indicating compliance with refrigerant management practices.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Provide plans, piping schematics, and details, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.

B. Welding Certificates: For each welder performing shop or field welding on Project.

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C. Field Quality-Control Reports: For each field quality-control test and inspection.

D. Qualification Statements: For refrigerant piping design.

1. Delegated design engineer qualifications.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding, Brazing, and Fusing Qualifications."

B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [**state**]<**Insert jurisdiction**> where Project is located and who is experienced in providing engineering services of the type indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," for refrigerant piping size and layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

B. Comply with ASHRAE 15 and ASHRAE 34.

C. Comply with ASME B31.5.

D. Test Pressure for Refrigerant R-410A:

1. Suction Tubing for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: [300 psig]<**Insert pressure**>.
2. Hot-Gas and Tubing Lines: [535 psig]<**Insert pressure**>.

E. Test Pressure for Refrigerant R-454B:

1. Suction Tubing for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: [300 psig]<**Insert pressure**>.
2. Suction Tubing for Heat-Pump Applications: [535 psig]<**Insert pressure**>.

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3. Hot-Gas and Tubing Lines: [535 psig]<**Insert pressure**>.

PART 3 - EXECUTION

3.1 PIPING APPLICATION SCHEDULES

A. Refrigerant: [**R-454B**][**R-410A**].

B. Suction, Hot-Gas, and Liquid Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with [**brazed**][**or**][**soldered**] joints.

C. Suction, Hot-Gas, and Liquid Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, NPS 4 (DN 100) and Smaller: Copper, [**Type ACR**][**Type L**], drawn-temper tubing and wrought-copper fittings with [**brazed**][**or**][**soldered**] joints.

D. Suction, Hot-Gas, and Liquid Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, NPS 2 to NPS 4 (DN 50 to DN 100): Copper, [**Type ACR**][**Type L**], drawn-temper tubing and wrought-copper fittings with [**brazed**][**or**][**soldered**] joints.

E. Safety-Relief-Valve Discharge Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, Copper: [**Type ACR**][**Type K**][**or**][**Type L**], [**drawn-temper**][**or**][**annealed-temper**] tubing and wrought-copper fittings with [**brazed**][**or**][**soldered**] joints.

F. Safety-Relief-Valve Discharge Piping for Conventional Air-Conditioning (Cooling-Only) Applications, Steel: Schedule 40, black steel and wrought-steel fittings with welded joints.

G. Suction, Hot-Gas, and Liquid Tubing for Heat-Pump Applications, NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with [**brazed**][**or**][**soldered**] joints.

H. Suction, Hot-Gas, and Liquid Tubing for Heat-Pump Applications, NPS 4 (DN 100) and Smaller: Copper, [**Type ACR**][**Type L**], drawn-temper tubing and wrought-copper fittings with [**brazed**][**or**][**soldered**] joints.

I. Suction, Hot-Gas, and Liquid Tubing for Heat-Pump Applications, NPS 2 to NPS 4 (DN 50 to DN 100): Copper, [**Type ACR**][**Type L**], drawn-temper tubing and wrought-copper fittings with [**brazed**][**or**][**soldered**] joints.

J. Safety-Relief-Valve Discharge Tubing for Heat-Pump Applications, Copper: [**Type ACR**][**Type K**][**or**][**Type L**], [**drawn-temper**][**or**][**annealed-temper**] tubing and wrought-copper fittings with [**brazed**][**or**][**soldered**] joints

K. Safety-Relief-Valve Discharge Piping for Heat-Pump Applications, Steel: Schedule 40, black steel and wrought-steel fittings with welded joints.

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3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install [**diaphragm packless**][**packed-angle**] valves in suction and discharge lines of compressor.

B. Install service valves for gauge taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install [**diaphragm packless**][**packed-angle**] valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety-relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside in accordance with ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve[**, and in the suction line at the compressor**].

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

N. Provide refrigerant locking caps on refrigerant charging ports that are located outdoors unless otherwise protected from unauthorized access by a means acceptable to

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authority having jurisdiction.

3.3 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping in accordance with ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away

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from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

S. Identify refrigerant piping and valves in accordance with Section 230553 "Identification for HVAC Piping and Equipment."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic restraints in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

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C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 ft. long.
2. Roller hangers and spring hangers for individual horizontal runs 20 ft. or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 ft. or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for [**copper tubing**][**and**][**steel piping**], with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within [12 inches]<**Insert dimension**> of each fitting.

F. Support vertical runs of [**copper tubing**][**and**][**steel piping**] to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner will engage**][**Engage**] a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System must maintain test pressure at the manifold gauge throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

C. Prepare test and inspection reports.

3.6 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

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2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

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SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet metal materials.
2. Sealants and gaskets.
3. Strut support system for ductwork - metal, cable type.

B. Related Requirements:

1. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components.
2. Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraint devices and installation.
3. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
4. Section 233116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
5. Section 233119.13 "Shop-Fabricated HVAC Casings" for field-fabricated casings for mechanical equipment.
6. Section 233119.16 "Manufactured HVAC Casings" for factory-fabricated casings for mechanical equipment.
7. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top[and bottom] of ducts.
5. Dimensions of [main][all] duct runs from building grid lines.
6. Fittings.

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7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment[**, seismic restraints,**] and vibration isolation.
13. <**Insert areas or systems requiring Shop Drawings**>.

C. Delegated Design Submittals:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations[**, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation**] for selecting hangers and supports[**and seismic restraints**].

D. Sustainable Design Submittals:

1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
2. Laboratory Test Reports:

a. For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.
b. For antimicrobial coatings, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

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1.5 MOCKUPS

A. Before installing duct systems, build mockups representing static-pressure classes in excess of [3-inch wg]<Insert static-pressure class>. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. [Five]<Insert number> transverse joints.
2. [One]<Insert number> access door(s).
3. [Two]<Insert number> typical branch connections, each with at least one elbow.
4. [Two]<Insert number> typical flexible duct or flexible-connector connections for each duct and apparatus.
5. [One]<Insert number> 90-degree turn(s) with turning vanes.
6. [One]<Insert number> fire damper(s).
7. [One]<Insert number> smoke damper(s).
8. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

B. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports[and seismic restraints] are to withstand the effects of gravity[and seismic] loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" [and][ASCE/SEI 7]<Insert applicable building code>. [Seismically brace duct hangers and supports in accordance with][SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."][SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems - OSHPD Edition."]<Insert reference document.>

1. Seismic Hazard Level (SHL): [AA][A][B][C][D].
2. Connection Level: [1][2].
3. <Insert requirement>.

C. Seismic Performance: Ductwork to withstand the effects of earthquake motions. See Section 018123 "Facility Seismic and Wind Criteria" that specifies basis-of-design seismic and wind criteria for nonstructural components. See Section 230548 "Vibration and Seismic Controls for HVAC."

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[and the

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unit will be fully operational after the seismic event]."
2. Component Importance Factor: [1.5][1.0].
3. <Insert requirements for Component Amplification Factor and Component Response Modification Factor>.

D. Wind-Restraint Performance: See Section 018123 "Facility Seismic and Wind Criteria" and Section 230548 "Vibration and Seismic Controls for HVAC" for building classification criteria.

E. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

G. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

H. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: [G60][G90].
2. Finishes for Surfaces Exposed to View: Mill phosphatized.
3. Lockforming Quality: Sheet steel and galvanized coating is to be able to be formed with back-to-back bends in seams such as the Pittsburgh lock at high speed without cracking or flaking of the coating on the outside of the bend.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: [G60][G90].
2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick[on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface].
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

E. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as

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indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish is to be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating is to be applied to the exterior surface.
2. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound is to have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: [Black][White].
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

H. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

I. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

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E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire[, combination fire/smoke,] and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.[Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."]

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

O. Installation of Metal, Cable-Type Strut Support System for Ductwork: Install in accordance with manufacturer's written installation instructions.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

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D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPE 1 COMMERCIAL KITCHEN GREASE HOOD EXHAUST DUCT

A. Install ducts in accordance with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operation"; SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; and SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines."

B. Install all ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

C. All ducts exposed to view are to be constructed of stainless steel as per "Duct Schedule" Article. All ducts concealed from view are to be [**stainless**][**carbon**] steel as per "Duct Schedule" Article.

D. All joints are to be welded and are to be telescoping, bell, or flange joint as per NFPA 96.

E. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of [20 ft.][12 ft.]<**Insert dimension**> in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.

F. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXHAUST DUCTS SERVING COMMERCIAL DISHWASHERS AND OTHER HIGH-HUMIDITY LOCATIONS

A. Install dishwasher exhaust ducts and other exhaust ducts from wet, high-humidity locations without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to dishwasher or toward drain.

B. Provide a drain pocket at each low point and at the base of each riser with a 1-inch trapped copper drain from each drain pocket to open-sight floor drain.

C. Minimize number of transverse seams.

D. Do not locate longitudinal seams on bottom of duct.

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3.5 ADDITIONAL INSTALLATION REQUIREMENTS FOR LABORATORY EXHAUST AND FUME HOOD EXHAUST DUCTS

A. Install ducts in accordance with NFPA 45, "Fire Protection for Laboratories Using Chemicals."

B. Install exhaust ducts without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to hood or inlet. Where indicated on Drawings, install trapped drain piping.

C. Connect duct to fan, fume hood, and other equipment indicated on Drawings.

3.6 INSTALLATION OF SEISMIC-RESTRAINT DEVICES

A. See Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraint installation requirements.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher than 3-Inch wg (750 Pa): Test representative duct sections[, **selected by Architect from sections installed,**] totaling no less than 25 percent of total installed duct area for each designated pressure class.
    b. Supply Ducts: For pressure class of [2-inch wg][3-inch wg][4-inch wg]<**Insert number**> or higher; test representative duct sections[, **selected by Architect from sections installed,**] totaling no less than [**50**][**100**]<**Insert number**> percent of total installed duct area for each designated pressure class.
    c. Return Ducts: For a pressure class of [2-inch wg][3-inch wg][4-inch wg]<**Insert number**> or higher; test representative duct sections[, **selected by Architect from sections installed,**] totaling no less than [**50**][**100**]<**Insert number**> percent of total installed duct area for each designated pressure class.
    d. Exhaust Ducts: For a pressure class of [2-inch wg][3-inch wg][4-inch wg]<**Insert number**> or higher; test representative duct sections[, **selected by Architect from sections installed,**] totaling no less than [**50**][**100**]<**Insert number**> percent of total installed duct area for each designated pressure class.
    e. Outdoor-Air Ducts: For a pressure class of [2-inch wg][3-inch wg][4-inch wg]<**Insert number**> or higher; test representative duct sections[, **selected by Architect from sections installed,**] totaling no less than

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[50][100]<Insert number> percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
5. Test for leaks before applying external insulation.
6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
7. Give [seven]<Insert number> days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning, and Restoration of HVAC Systems."

   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media is to not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
2. Underground Ducts: Concrete-encased, [galvanized sheet steel][PVC-coated, galvanized sheet steel with thicker coating on duct exterior][stainless steel].
3. <Insert requirements>.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units: <Insert equipment>.

   a. Pressure Class: Positive [1-inch wg][2-inch wg]<Insert number>.
   b. Minimum SMACNA Seal Class: [A][B][C].
   c. SMACNA Leakage Class for Rectangular: [2][4][8][16].
   d. SMACNA Leakage Class for Round and Flat Oval: [2][4][8][16].

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2. Ducts Connected to Constant-Volume Air-Handling Units: <**Insert equipment**>.

    a. Pressure Class: Positive [2-inch wg][3-inch wg]<**Insert number**>.
    b. Minimum SMACNA Seal Class: [**A**][**B**].
    c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
    d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

3. Ducts Connected to Variable-Air-Volume Air-Handling Units: <**Insert equipment**>.

    a. Pressure Class: Positive [3-inch wg][4-inch wg]<**Insert number**>.
    b. Minimum SMACNA Seal Class: [**A**][**B**].
    c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
    d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

4. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive [2-inch wg][3-inch wg][4-inch wg]<**Insert number**>.
    b. Minimum SMACNA Seal Class: [**A**][**B**][**C**].
    c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
    d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units: <**Insert equipment**>.

    a. Pressure Class: Positive or negative [1-inch wg][2-inch wg]<**Insert number**>.
    b. Minimum SMACNA Seal Class: [**A**][**B**][**C**].
    c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
    d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

2. Ducts Connected to Air-Handling Units: <**Insert equipment**>.

    a. Pressure Class: Positive or negative [2-inch wg][3-inch wg]<**Insert number**>.
    b. Minimum SMACNA Seal Class: [**A**][**B**][**C**].
    c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
    d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

3. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative [2-inch wg][3-inch wg][4-inch wg]<**Insert number**>.
    b. Minimum SMACNA Seal Class: [**A**][**B**][**C**].
    c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
    d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

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a. Pressure Class: Negative [1-inch wg][2-inch wg][3-inch wg]<**Insert number**>.
b. Minimum SMACNA Seal Class: [**A**][**B**][**C**] if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

2. Ducts Connected to Air-Handling Units: <**Insert equipment**>.

a. Pressure Class: Positive or negative [2-inch wg][3-inch wg]<**Insert number**>.
b. Minimum SMACNA Seal Class: [**A**][**B**][**C**] if negative pressure, and [**A**][**B**][**C**] if positive pressure.
c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless steel sheet, [**No. 4**][**No. 3**]<**Insert finish**> finish.
b. Concealed: [**Type 304, stainless steel sheet, No. 2D finish**][**Carbon-steel sheet**].
c. Welded seams and joints.
d. Pressure Class: Positive or negative [2-inch wg][3-inch wg][4-inch wg]<**Insert number**>.
e. Airtight/watertight.

4. Ducts Connected to Dishwashers, Dishwasher Hoods, and Other High-Humidity Locations:

a. Type 304, stainless steel sheet.
b. Exposed to View: [**No. 4**][**No. 3**]<**Insert finish**> finish.
c. Concealed: [**No. 2D**]<**Insert finish**> finish.
d. Welded longitudinal seams; welded or flanged transverse joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative [2-inch wg][3-inch wg]<**Insert number**>.
f. Airtight/watertight.

5. Ducts Connected to Fans Exhausting Fume Hood, Laboratory, and Process (ASHRAE 62.1, Class 3 and Class 4) Air:

a. [**Type 316**][**Type 304**], stainless steel sheet.

1) Exposed to View: [**No. 4**][**No. 3**]<**Insert finish**> finish.
2) Concealed: [**No. 2B**][**No. 2D**]<**Insert finish**> finish.

b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.
c. Pressure Class: Positive or negative [3-inch wg][4-inch wg][6-inch wg]<**Insert number**>.
d. Seal Class: [**Minimum SMACNA Seal Class A**]<**Insert seal class**>.

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e. Joints: [**Welded seams and joints, airtight/watertight**]<**Insert seam and joint types**>.
f. Leakage Class: [**SMACNA Leakage Class 2**]<**Insert leakage class**>.

6. Ducts Connected to Equipment Not Listed above:

a. Pressure Class: Positive or negative [2-inch wg][3-inch wg][4-inch wg]<**Insert number**>.
b. Minimum SMACNA Seal Class: [**A**][**B**] if negative pressure; A if positive pressure.
c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units <**Insert equipment**>:

a. Pressure Class: Positive or negative [1-inch wg][2-inch wg]<**Insert number**>.
b. Minimum SMACNA Seal Class: [**A**][**B**][**C**].
c. SMACNA Leakage Class for Rectangular: [**8**][**16**].
d. SMACNA Leakage Class for Round and Flat Oval: [**8**][**16**].

2. Ducts Connected to Air-Handling Units <**Insert equipment**>:

a. Pressure Class: Positive or negative [2-inch wg][3-inch wg]<**Insert number**>.
b. Minimum SMACNA Seal Class: [**A**][**B**].
c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative [2-inch wg][3-inch wg][4-inch wg]<**Insert number**>.
b. Minimum SMACNA Seal Class: [**A**][**B**].
c. SMACNA Leakage Class for Rectangular: [**2**][**4**][**8**][**16**].
d. SMACNA Leakage Class for Round and Flat Oval: [**2**][**4**][**8**][**16**].

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: [**Galvanized steel**][**Carbon steel coated with zinc-chromate primer**][**Galvanized steel or carbon steel coated with zinc-chromate primer**].
2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: [**Galvanized**][**Match duct material**].

3. Stainless Steel Ducts:

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a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: [**Galvanized**][**Match duct material**].

4. Aluminum Ducts: [**Aluminum**][**or**][**galvanized steel coated with zinc chromate**].

G. Liner:

1. Supply-Air Ducts: [**Fibrous glass, Type I**][**Flexible elastomeric**][**Fibrous-glass-free, natural fiber**][**Polyolefin**], [5/8 inch][1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
2. Return-Air Ducts: [**Fibrous glass, Type I**][**Flexible elastomeric**][**Fibrous-glass-free, natural fiber**][**Polyolefin**], [5/8 inch][1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
3. Exhaust-Air Ducts: [**Fibrous glass, Type I**][**Flexible elastomeric**][**Fibrous-glass-free, natural fiber**][**Polyolefin**], [5/8 inch][1 inch]<**Insert dimension**> thick.
4. Supply Fan Plenums: [**Fibrous glass, Type II**][**Flexible elastomeric**][**Fibrous-glass-free, natural fiber**][**Polyolefin**], [5/8 inch][1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
5. Return- and Exhaust-Fan Plenums: [**Fibrous glass, Type II**][**Flexible elastomeric**][**Fiberglass-free, natural fiber**][**Polyolefin**], [5/8 inch][1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
6. Transfer Ducts: [**Fibrous glass, Type I**][**Flexible elastomeric**][**Fibrous-glass-free, natural fiber**][**Polyolefin**], [5/8 inch][1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.

H. Double-Wall Duct Interstitial Insulation:

1. Supply-Air Ducts: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
2. Return-Air Ducts: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.
3. Exhaust-Air Ducts: [1 inch][1-1/2 inches][2 inches]<**Insert dimension**> thick.

I. Elbow Configuration:

1. Rectangular Duct - Requirements for Different Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm (5 m/s) or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

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c. Velocity 1500 fpm (7.6 m/s) or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct - Requirements for All Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to-Diameter Ratio: 1.5.

b. Round Elbows:

1) Stamped or pleated for [12 inches]<**Insert dimension**> and smaller diameters.
2) Standing seam for [14 inches]<**Insert dimension**> and larger diameter.
3) Welded for [14 inches]<**Insert dimension**> and larger diameter.

J. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

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b. Rectangular Main to Round Branch: Conical spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

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SECTION 238129 - VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: VRF HVAC systems.

1. Indoor, concealed, ceiling-mounted units for ducting.
2. Indoor, concealed, floor-mounted units for ducting.
3. Indoor, exposed, floor-mounted units.
4. Indoor, exposed, wall-mounted units.
5. Indoor, recessed, ceiling-mounted units.
6. Indoor, suspended, ceiling-mounted units.
7. Indoor, hydronic heat exchangers.
8. Indoor, dedicated outdoor air ventilation units.
9. Indoor, energy recovery ventilator.
10. Indoor, hydronic heat-pump units.
11. Indoor, hydronic heat recovery units.
12. Outdoor, air-source heat-pump units.
13. Outdoor, air-source heat recovery units.
14. Heat recovery control units (HRCUs).
15. System controls.
16. System refrigerant and oil.
17. System condensate drain piping.
18. System hydronic piping.
19. System refrigerant piping.
20. Metal hangers and supports.
21. Metal framing systems.
22. Fastener systems.
23. Pipe stands.
24. Outdoor equipment stands.
25. Miscellaneous support materials.
26. Piping and tubing insulation.
27. System control cable.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

1.3 ACTION SUBMITTALS

A. Product Data: For VRF HVAC system components.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units[**and for**

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HRCUs].

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit [and HRCU]control.
6. Include description of control software features.
7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Sustainable Design Submittals:

1. Product Data: For minimum energy performance.
2. Product Data: For refrigerants, indicating compliance with refrigerant management practices.
3. Product Data: For continuous metering equipment for energy consumption.
4. <Insert LEED submittal requirements>.

C. Shop Drawings: For VRF HVAC systems.

1. Include plans, elevations, sections, and [mounting][attachment] details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: For fully and partially exposed indoor units with factory finishes viewable by occupants.

1. Include a Sample for each unique finish with unit identification, detailed description of application, and cross-referenced floor plans showing locations.

E. Delegated Design Submittals:

1. Include design calculations for selecting vibration isolators[and seismic restraints] and for designing vibration isolation bases.
2. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.

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3. Include design calculations with corresponding floor plans indicating that refrigerant concentration limits are within allowable limits of ASHRAE 15 and governing codes.
4. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.
5. <Insert delegated design submittal>.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural floors, roofs and associated members to which equipment, piping, [ductwork,]cables, and conduit will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Wall-mounted controllers located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
5. Size and location of access doors and panels installed behind walls and inaccessible ceilings for products installed behind walls and requiring access.
6. Items penetrating finished ceiling including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Service access panels.
    f. <Insert item>.

B. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.

    a. Retain copies of Installer certificates on-site and make available on request.

2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

C. Seismic Qualification Data: Certificates, for equipment, <Insert products,> accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

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2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For VRF HVAC system components.

1. <Insert list of products>.

E. Product Test Reports: Where tests are required, for each product, for tests performed by [manufacturer and witnessed by a qualified testing agency][or][a qualified testing agency].

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of [five][10]<Insert number> years within time of bid.
3. VRF HVAC systems and products that have been successfully tested and in use on at least [three][five]<Insert number> completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

a. Product research and development.
b. Product and application engineering.
c. Product manufacturing, testing, and quality control.
d. Technical support for system installation training, startup, commissioning,

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and troubleshooting of installations.

e. Owner training.

B. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
2. In-place facility located within <Insert distance> of Project.
3. Demonstrated past experience with products being installed for period within [three][five]<Insert number> consecutive years before time of bid.
4. Demonstrated past experience on [five]<Insert number> projects of similar complexity, scope, and value.

    a. Each person assigned to Project shall have demonstrated past experience.

5. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
6. Service and maintenance staff assigned to support Project during warranty period.
7. Product parts inventory to support ongoing system operation for a period of not less than [five]<Insert number> years after Substantial Completion.
8. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to Project shall have demonstrated past experience.

    a. Demonstrated past experience with products being installed for period within [three][five]<Insert number> consecutive years before time of bid.
    b. Demonstrated past experience on [five]<Insert number> projects of similar complexity, scope, and value.

D. Mockups: Build mockups to set quality standards for materials and execution.

1. Build mockups to show a finished installation for each of the following applications:

    a. For each different indoor unit type with exposed surfaces viewable by occupants.
    b. <Insert mockup item>.

2. Mockups [shall be][are] operational.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves

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such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
d. <**Insert failure modes**>.

2. Warranty Period:

a. For Compressor: [**Five**][**Seven**][**10**]<**Insert number**> year(s) from date of Substantial Completion.
b. For Parts, Including Controls: [**Five**][**Seven**][**10**]<**Insert number**> year(s) from date of Substantial Completion.
c. For Labor: [**Five**][**Seven**][**10**]<**Insert number**> year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, [**HRCUs,**]outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

1. [**Two-pipe**][**or**][**three-pipe**] system design.
2. System(s) operation, [**air-conditioning**][**heat pump**][**or**][**heat recovery**] as indicated on Drawings.
3. Each system with one refrigerant circuit shared by all indoor units connected to system.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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C. AHRI Compliance: System and equipment performance certified according to AHRI 1230[and products listed in AHRI directory].

D. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional [engineer][specialist], as defined in Section 014000 "Quality Requirements," to design complete and operational VRF HVAC system(s) complying with requirements indicated.

1. Provide system refrigerant calculations.

a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.

2. Include a mechanical ventilation system and gas detection system as required to comply with ASHRAE 15 and governing codes.
3. System Refrigerant Piping and Tubing:

a. Arrangement: Arrange piping to interconnect indoor units[, HRCUs,] and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.

4. System Controls:

a. Network arrangement.
b. Network interface with other building systems.
c. Product selection.
d. Sizing.

B. Service Access:

1. Provide and document service access requirements.

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2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
6. Comply with OSHA regulations.

C. System Design and Installation Requirements:

1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

D. System Adaptability to Future Changes: Arrange and size system refrigerant piping to accommodate future changes to system without having to resize and replace existing refrigerant piping.

1. Future changes to system(s) indicated on Drawings.
2. Each branch circuit shall accommodate addition of [**one**][**two**]<**Insert number**> indoor unit(s) with unit capacity equal to [**largest**][**smallest**][**average**]<**Insert capacity requirement**> indoor unit connected to the branch circuit.
3. Each branch circuit shall accommodate deletion of [**one**][**two**]<**Insert number**> indoor unit(s) with unit capacity equal to [**largest**][**smallest**][**average**]<**Insert capacity requirement**> indoor unit connected to the branch circuit.
4. <**Insert requirements for future changes**>.

E. Isolation of Equipment: Provide isolation valves to isolate each [**HRCU,**]indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

F. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:

1. Not less than [**50**][**60**]<**Insert number**> percent.
2. Not more than [**130**][**150**]<**Insert number**> percent.
3. Range acceptable to manufacturer.

G. System Turndown: Stable operation down to [**20**]<**Insert number**> percent of outdoor-unit capacity.

H. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

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I. Outdoor Conditions:

1. Suitable for outdoor ambient conditions encountered.

a. Design equipment and supports to withstand wind loads of governing code [and ASCE/SEI 7]<Insert requirement>.
b. Design equipment and supports to withstand snow and ice loads of governing code [and ASCE/SEI 7]<Insert requirement>.
c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.

2. Maximum System Operating Outdoor Temperature: [See Drawings]<Insert value>.
3. Minimum System Operating Outdoor Temperature: [See Drawings]<Insert value>.

J. Seismic Performance: VRF HVAC system(s) shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7]<Insert requirement>.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified[and the system will be fully operational after the seismic event]."
2. Component Importance Factor: [1.5][1.0]<Insert value>.
3. <Insert requirements for Component Amplification Factor and Component Response Modification Factor>.

K. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated.

1. Indoor: [See Drawings.][Within design guidelines of "2015 ASHRAE HANDBOOK- HVAC Applications."]<Insert values.>
2. Outdoor: [See Drawings][Within ordinance of governing authorities]<Insert values>.

L. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

M. Capacities and Characteristics: As indicated on Drawings.

2.3 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units[, HRCUs,] and outdoor units shall include integral controls and connect through a [TIA-485A][or][manufacturer-selected]<Insert network type> control network.
2. Network Communication Protocol: [Manufacturer proprietary][or][open] control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and

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certified by BACnet Testing Lab (BTL), including the following:

a. Ethernet connection via RJ-45 connectors and port with transmission at [100]<Insert value> Mbps or higher.
b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least [5 minutes]<Insert time> of battery backup operation after a power loss.
c. Integration shall include [control][monitoring][scheduling][change of value notifications]<Insert requirements>.
d. <Insert requirements>.

4. Operator Interface:

a. Operators shall interface with system and unit controls through the following:

1) Operator interfaces integral to controllers.
2) Owner-furnished PC connected to central controller(s).
3) Web interface through web browser software.
4) Integration with Building Automation System.

b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:

1) On/off control.
2) Temperature set-point adjustment.
3) <Insert feature>.

B. VRF HVAC System Operator Software for PC:

1. Software offered by VRF HVAC system manufacturer shall provide system operators with ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.
2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-and-click mouse exchange.
3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.
4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
7. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.

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8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
9. Supports Multiple Languages: [**English**][**or**][**French**][**Spanish**]<**Insert language**>.
10. Supports Imperial and Metric Temperature Units: [**Fahrenheit**][**or**][**Celsius**][**Fahrenheit and Celsius**].
11. Displays service notifications and error codes.
12. Monitors and displays up to [**3000**]<**Insert number**> item error history and [**10000**]<**Insert number**> item operation history for regular reporting and further archiving.
13. Monitors and displays cumulative operating time of indoor units.
14. Able to disable and enable operation of individual controllers for indoor units.
15. Information displayed on individual controllers shall also be available for display.
16. Information displayed for outdoor units, including refrigerant high and low pressures [**percent capacity**]<**Insert outdoor unit displays**>.

C. Central Controllers:

1. Centralized control for all indoor and outdoor units from a single central controller location.

    a. Include multiple interconnected controllers as required.

2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

    a. Sets schedule for daily, weekly, and annual events.
    b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.

4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
5. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures [**percent capacity**]<**Insert outdoor unit displays**>.
11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel[**and web accessible through standard web browser software**].

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D. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: [**English**][**or**][**French**][**Spanish**]<**Insert language**>.
4. Temperature Units: [**Fahrenheit**][**or**][**Celsius**][**Fahrenheit and Celsius**].
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between <**Insert temperature range**>.
10. Relative Humidity Display: 1 percent increments.
11. Relative Humidity Set-Point: Adjustable in 1 percent increments between <**Insert relative humidity range**>.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule with up to [**five**][**eight**]<**Insert number**> events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Occupancy detection.
17. Service Notification Display: "Filter" <**Insert notifications**>.
18. Service Run Tests: Limit use by service personnel to troubleshoot operation.
19. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
20. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
21. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
22. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.
23. <**Insert features and functions**>.

E. Wireless Controllers for Indoor Units:

1. Wireless Communication:

    a. Controller communicates to remote-mounted receiver that is wired to indoor unit(s).

        1) Include receivers with wireless controllers as required to complete installation.
        2) Low-voltage power required for receivers shall be powered through non-polar connections to indoor unit.

    b. One wireless controller shall be capable of communicating with one or multiple receivers to control one or multiple indoor units as a group.

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2. Controller Battery Life: [**Three**]<**Insert number**> years.
3. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
4. Multiple Language: [**English**][**or**][**French**][**Spanish**]<**Insert language**>.
5. Temperature Units: [**Fahrenheit**][**or**][**Celsius**][**Fahrenheit and Celsius**].
6. On/Off: Turns indoor unit on or off.
7. Hold: Hold operation settings until hold is released.
8. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
9. Temperature Display: 1-degree increments.
10. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between <**Insert temperature range**>.
11. Relative Humidity Display: 1 percent increments.
12. Relative Humidity Set-Point: Adjustable in 1 percent increments between <**Insert relative humidity range**>.
13. Fan Speed Setting: Select between available options furnished with the unit.
14. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
15. Seven-day programmable operating schedule with up to [**five**][**eight**]<**Insert number**> events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
16. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
17. Occupancy detection.
18. Service Notification Display: "Filter" <**Insert notifications**>.
19. Service Run Tests: Limit use by service personnel to troubleshoot operation.
20. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
21. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
22. Setting stored in non-volatile memory to ensure that settings are not lost if power is lost. Battery for date and time only.
23. <**Insert features and functions**>.

2.4 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, [**Class A1**][**or**]<**Insert classification**> refrigerant classification.
3. [**R-410a**][**or**]<**Insert refrigerant**>.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.5 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

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B. Copper Tubing:

1. Drawn-Temper Tubing: According to [ASTM B88, Type L][ASTM B88, Type M] or Type DWV according to ASTM B306.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B32, lead-free alloys, and water-flushable flux according to ASTM B813.

C. CPVC plastic pipe according to ASTM F441/F441M, Schedule 40, with socket-type pipe fittings according to ASTM F438 and solvent cement according to ASTM F493.

D. PVC plastic pipe according to ASTM D1785, Schedule 40, with socket-type pipe fittings according to ASTM D2466 and solvent cement according to ASTM D2564, primer according to ASTM F656.

2.6 SYSTEM HYDRONIC PIPING

A. Comply with requirements in Section 232113 "Hydronic Piping" for system piping requirements.

2.7 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Refrigerant Piping:

1. Copper Tube: [**ASTM B280, Type ACR**]<**Insert material**>.
2. Wrought-Copper Fittings: ASME B16.22.
3. Brazing Filler Metals: AWS A5.8/A5.8M.

C. Refrigerant Tubing Kits:

1. Furnished by VRF HVAC system manufacturer.
2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
3. Standard one-piece length for connecting to indoor units.
4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
5. Factory Charge: [**Dehydrated air or nitrogen**][**or**]<**Insert charge**>.

D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

E. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature

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and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.8 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: [**Zinc-coated**][**or**][**stainless**] steel.
2. Outdoor Applications: Stainless steel.

2.9 MISCELLANEOUS SUPPORT MATERIALS

A. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.10 SYSTEM CONTROL CABLE

A. Cable Rating: Listed and labeled for application according to NFPA 70.

1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

a. Flame Travel Distance: 60 inches or less.
b. Peak Optical Smoke Density: 0.5 or less.
c. Average Optical Smoke Density: 0.15 or less.

2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-

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Plenum Building Spaces: As determined by testing identical products according to UL 1685.

B. Low-Voltage Control Cabling:

1. Paired Cable: NFPA 70, Type CMG.

a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
b. PVC insulation.
c. Braided or foil shielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
b. PVC insulation.
c. Braided or foil shielded.
d. PVC jacket.
e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
f. Flame Resistance: Comply with NFPA 262.

C. TIA-485A Network Cabling:

1. Standard Cable: NFPA 70, Type CMG.

a. Paired, [one pair][two pairs], twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
b. PVC insulation.
c. Unshielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated Cable: NFPA 70, Type CMP.

a. Paired, [one pair][two pairs], No. 22 AWG, stranded (7x30) tinned-copper conductors.
b. Fluorinated ethylene propylene insulation.
c. Unshielded.
d. Fluorinated ethylene propylene jacket.
e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
f. Flame Resistance: NFPA 262.

D. Ethernet Network Cabling: TIA-568-C.2 Category [6][6a]<Insert category> cable with [RJ-45]<Insert connector type> connectors.

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1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
2. Conductors: 100-ohm, 23 AWG solid copper.
3. Shielding: [**Unshielded twisted pairs (UTP)**][**Shielded twisted pairs (FTP)**].
4. Cable Rating: By application.
5. Jacket: [**White**][**Gray**][**Blue**][**Yellow**]<**Insert color**> thermoplastic.

E. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems" for cable raceways.

2.11 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.

F. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a [**3000**]<**Insert time**>-hour salt-spray test according to ASTM B117.

1. Standards:

a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of **100 in-lb**.
c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: [**Immersion**][**Spray**].
3. Thickness: [**1 mil**]<**Insert value**>.
4. Gloss: Minimum gloss of 60 on a 60-degree meter.

2.12 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports for historical record. Submit reports only if

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requested.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

1. Loose components shall be installed by [**manufacturer's service representative**][**or**][**system Installer under supervision of manufacturer's service representative**].

C. Equipment Restraint Installation: Install equipment with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3.2 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.

C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.

D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. Provide lateral bracing if needed to limit movement of suspended units to not more than [0.25 inch]<**Insert dimension**>.

H. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

I. Floor-mounted units located in [**mechanical**]<**Insert room type**> rooms.

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J. Install floor-mounted units on support structure indicated on Drawings.

K. Install floor-mounted units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

L. Attachment: Install hardware for proper attachment to supported equipment.

M. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.3 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Install outdoor units on support structures indicated on Drawings.

C. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Grouting: Place grout under equipment supports and make bearing surface smooth.

D. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, stainless steel fasteners.

3.4 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

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H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.5 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:

    a. Details indicated on Drawings.
    b. Manufacturer's requirements.
    c. Governing codes.
    d. In the absence of requirements, comply with requirements of ASHRAE handbooks.

4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than [one][two]<Insert number> percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

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3.6 INSTALLATION OF HYDRONIC PIPING

A. Comply with requirements for hydronic pipe and tubing specified in Section 232113 "Hydronic Piping."

B. Comply with requirements for hydronic specialties specified in Section 232116 "Hydronic Piping Specialties."

C. Comply with requirements for ball valves specified in Section 230523.12 "Ball Valves for HVAC Piping."

D. Comply with requirements for butterfly valves specified in Section 230523.13 "Butterfly Valves for HVAC Piping."

E. Comply with requirements for check valves specified in Section 230523.14 "Check Valves for HVAC Piping."

F. Install continuous-thread hanger rods and [**elastomeric**][**spring**] hangers of size required to support equipment weight.

1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

G. Where installing piping and tubing adjacent to equipment, allow space for service and maintenance.

3.7 INSTALLATION OF REFRIGERANT PIPING

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed [5 ft.]<**Insert dimension**>. Minimum rod size, 1/4 inch.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

D. Install piping as short and direct as possible, with a minimum number of joints and fittings.

E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access

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doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

F. Install refrigerant piping and tubing in protective conduit where installed belowground.

G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Joint Construction:

1. Ream ends of tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.8 INSTALLATION OF METAL HANGERS AND SUPPORTS

A. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Comply with MFMA-103 for metal framing system selections and applications that are not specified.

E. Fastener System Installation:

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1. Install powder-actuated fasteners, for use in lightweight concrete or concrete slabs less than 4 inches thick, in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel.

1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Piping and Tubing Insulation:

1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
2. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

N. Horizontal-Piping Hangers and Supports: Install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

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2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu if individual clevis hangers.
5. Pipe stands for horizontal pipes located outdoors.
6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

O. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:

1. Sizes through NPS 3/4: Maximum span, 5 ft.; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 ft.; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 ft.; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 ft.; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 ft.; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 ft.; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 ft.; minimum rod size, 3/8 inch.

P. Plastic Pipe Hanger and Support Spacing:

1. Space hangers and supports according to pipe manufacturer's written instructions for service conditions.
2. Maximum spacing, 5 ft.; minimum rod size, 1/4 inch.

Q. Vertical-Piping Clamps: Install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.

R. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed [5 ft.][10 ft.]<**Insert dimension**>.

S. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.

T. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.

U. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

V. Trim excess length of continuous-thread hanger and support rods to [1 inch]<**Insert dimension**>.

W. Hanger-Rod Attachments: Install the following types:

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1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

X. Building Attachments: Install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.9 INSTALLATION OF PIPING AND TUBING INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.

B. Insulation Installation on Pipe Fittings and Elbows:

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1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.10 INSTALLATION OF DUCT, ACCESSORIES, AND AIR OUTLETS

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 233113 "Metal Ducts."

C. Comply with requirements for nonmetal ducts specified in Section 233116 "Nonmetal Ducts."

D. Comply with requirements for air duct accessories specified in Section 233300 "Air Duct Accessories."

E. Comply with requirements for flexible ducts specified in Section 233346 "Flexible Ducts."

F. Comply with requirements for air diffusers specified in Section 233713.13 "Air Diffusers."

G. Comply with requirements for registers and grilles specified in Section 233713.23 "Registers and Grilles."

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3.11 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:

1. Install cables in raceways except as follows:

a. Within equipment and associated control enclosures.
b. In accessible ceiling spaces where open cable installation method may be used.
c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

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D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than [30 inches]<Insert dimension> apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.12 GROUNDING INSTALLATION

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.13 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by [an employee][or][a factory-trained and -authorized service representative] of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.

   a. Additional factory-authorized representatives may assist with completion of certain activities only if supervised by manufacturer's employee. A factory-authorized representative shall not provide assistance without manufacturer's employee supervision.

2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.

   a. First Visit: Kick-off meeting.
   b. Second Visit: At approximately [25]<Insert number> percent completion of system(s).

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c. Third Visit: At approximately [50]<Insert number> percent completion of system(s).
d. Fourth Visit: At approximately [75]<Insert number> percent completion of system(s).
e. Fifth Visit: Final inspection before system startup.

3. Kick-off Meeting:

a. Meeting shall include system Installer and other related trades with sole purpose of reviewing VRF HVAC system installation requirements and close coordination required to make a successful installation.
b. Meeting shall be held at Project site and scheduled at a mutually agreed to time that occurs before the start of any part of system installation.
c. Meeting shall cover the following as a minimum requirement:

1) Review of latest issue of Contract Documents, Drawings, and Specifications, relevant to VRF HVAC systems.
2) Manufacturer's installation requirements specific to systems being installed.
3) Review of all relevant VRF HVAC system submittals, including delegated design submittals.
4) Required field activities related installation of VRF HVAC system.
5) Project team communication protocol, contact information, and exchange of responsibilities for each party involved, including manufacturer, supplier, system Installer, and other related trades.

4. Site Visits: Activities for each site visit shall include the following:

a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
d. Advise and if necessary assist Installer with updating related refrigerant calculations and system documentation.
e. Issue a report for each visit, documenting the visit.

1) Report to include name and contact information of individual making the visit.
2) Date(s) and time frames while on-site.
3) Names and contact information of people meeting with while on-site.
4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.

5. Final Inspection before Startup:

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a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.
b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
d. Inspection reports for indoor units shall include, but not be limited to, the following:

    1) Unit designation on Drawings.
    2) Manufacturer model number.
    3) Serial number.
    4) Network address, if applicable.
    5) Each equipment setting.
    6) Mounting, supports, and restraints properly installed.
    7) Proper service clearance provided.
    8) Wiring and power connections correct.
    9) Line-voltage reading(s) within acceptable range.
    10) Wiring and controls connections correct.
    11) Low-voltage reading(s) within an acceptable range.
    12) Controller type and model controlling unit.
    13) Controller location.
    14) Temperature settings and readings within an acceptable range.
    15) Humidity settings and readings within an acceptable range.
    16) Condensate removal acceptable.
    17) Fan settings and readings within an acceptable range.
    18) Unit airflow direction within an acceptable range.
    19) If applicable, fan external static pressure setting.
    20) Filter type and condition acceptable.
    21) Noise level within an acceptable range.
    22) Refrigerant piping properly connected and insulated.
    23) Condensate drain piping properly connected and insulated.
    24) If applicable, ductwork properly connected.
    25) If applicable, external interlocks properly connected.
    26) Remarks.

e. Inspection reports for outdoor units shall include, but not be limited to, the following:

    1) Unit designation on Drawings.
    2) Manufacturer model number.
    3) Serial number.
    4) Network address, if applicable.
    5) Each equipment setting.
    6) Mounting, supports, and restraints properly installed.
    7) Proper service clearance provided.

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8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Condensate removal acceptable.
13) Noise level within an acceptable range.
14) Refrigerant piping properly connected and insulated.
15) Condensate drain piping properly connected and insulated.
16) Remarks.

f. Inspection reports for indoor, dedicated outdoor air ventilation units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Refrigerant piping properly connected and insulated.
22) Condensate drain piping properly connected and insulated.
23) Automatic dampers properly installed and operating.
24) Ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

g. Inspection reports for energy recovery ventilators shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.

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8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity readings.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Automatic dampers properly installed and operating.
22) Ductwork properly connected.
23) If applicable, external interlocks properly connected.
24) Remarks.

h. Inspection reports for hydronic units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Condensate removal acceptable.
16) Noise level within an acceptable range.
17) Refrigerant piping properly connected and insulated.
18) Hydronic piping properly connected and insulated.
19) Proof of water flow checked for proper operation.
20) Condensate drain piping properly connected and insulated.
21) If applicable, external interlocks properly connected.
22) Remarks.

i. Installer shall provide manufacturer with the requested documentation and technical support during inspection.
j. Installer shall correct observed deficiencies found by the inspection.
k. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.

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l. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
m. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

B. Perform the following tests and inspections with the assistance of manufacturer's service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than [1.2][1.5]<Insert value> times VRF HVAC system operating pressure, but not less than [600 psig]<Insert value>, using [dry nitrogen]<Insert test medium>.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of [24]<Insert number> hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
4. Prepare test report to record the following information for each test:

a. Name of person starting test, company name, phone number, and e-mail address.
b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
c. Detailed description of extent of tubing tested.
d. Date and time at start of test.
e. Test pressure at start of test.
f. Outdoor temperature at start of test.
g. Name of person ending test, company name, phone number, and e-mail address.
h. Date and time at end of test.
i. Test pressure at end of test.
j. Outdoor temperature at end of test.
k. Remarks:

5. Submit test reports for Project record.

D. Refrigerant Tubing Evacuation Testing:

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1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of [500]<Insert value> microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of [one]<Insert number> hour(s) with no change.
4. Prepare test report to record the following information for each test:

    a. Name of person starting test, company name, phone number, and e-mail address.
    b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
    c. Detailed description of extent of tubing tested.
    d. Date and time at start of test.
    e. Test pressure at start of test.
    f. Outdoor temperature at start of test.
    g. Name of person ending test, company name, phone number, and e-mail address.
    h. Date and time at end of test.
    i. Test pressure at end of test.
    j. Outdoor temperature at end of test.
    k. Remarks:

5. Submit test reports for Project record.
6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

E. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

F. Products will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.14 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include [12]<Insert duration> months' full maintenance by [skilled employees of system Installer][who are][manufacturer's authorized service representative]. Include [two][four]<Insert number> service visits for preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as

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required for proper equipment and system operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.15 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's [employed training instructor][or][factory-authorized service representative] to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

B. Instructor:

1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.
2. Instructor's credentials shall be submitted for review by [Architect][Commissioning Agent][Owner] before scheduling training.
3. Instructor(s) [primary][sole] job responsibility shall be Owner training.
4. Instructor(s) shall have not less than [three]<Insert number> years of training experience with VRF HVAC system manufacturer and past training experience on at least [three]<Insert number> projects of comparable size and complexity.

C. Schedule and Duration:

1. Schedule training with Owner at least [20]<Insert number> business days before first training session.
2. Training shall occur before Owner occupancy.
3. Training shall be held at mutually agreed date and time during normal business hours.
4. Each training day shall not exceed [eight]<Insert number> hours of training. Daily training schedule shall allow time for [one]<Insert number>-hour lunch period and [15]<Insert number>-minute break after every [two]<Insert number> hours of training.
5. Perform not less than [eight][16][24]<Insert number> total hours of training.

D. Location: Owner shall provide a suitable on-site location to host classroom training.

E. Training Attendees: Assume [three]<Insert number> people.

F. Training Attendance: For record purposes, document training attendees at the start of each new training session. Record attendee's name, signature, phone number, and e-mail address.

G. Training Format: Individual training modules shall include classroom training followed by hands-on field demonstration and training.

H. Training Materials: Provide training materials in electronic format to each attendee.

1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
2. Video record each classroom training session and submit an electronic copy to

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Owner before requesting Owner acceptance of training.

I. Acceptance: Obtain [Architect][Commissioning Agent][or][Owner] written acceptance that training is complete and requirements indicated have been satisfied.

END OF SECTION 238129

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SECTION 238239.19 - WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wall and ceiling unit heaters with propeller fans and electric-resistance heating coils.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Sustainable Design Submittals:

1. Product Data: For ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include details of anchorages and attachments to structure and to supported equipment.
4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
5. Wiring Diagrams: Power, signal, and control wiring.

D. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 238239.19

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SECTION 260010 - SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements generally applicable to all electrical Work on the Project, including but not limited to Work specified in Divisions 26, 27, and 28.

B. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies basis-of-design environmental conditions and performance criteria that are applicable to product selection and installation of the Work on the Project.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components on the Project.
3. [**Section 013100 "Project Management and Coordination"**]<**Insert Section number and title**> specifies preinstallation conference procedures.

1.2 PREINSTALLATION MEETINGS

A. Electrical Preconstruction Conference: Schedule conference with Architect and Owner, not later than [**10**]<**Insert number**> days after Notice to Proceed. Agenda topics include, but are not limited to, the following:

1. Electrical installation schedule.
2. Status of power system studies.
3. Value analysis proposals and requests for substitution of electrical equipment.
4. Utility work coordination and class of service requests.
5. Commissioning activities.
6. Sustainability activities[**, including Measurement and Verification Plan**].

B. Communications Preconstruction Conference: Schedule conference with Architect and Owner not later than [**10**]<**Insert number**> days after Notice to Proceed. Agenda topics include, but are not limited to, the following:

1. Installation schedule for communications systems.
2. Value analysis proposals and requests for substitution of communications equipment.
3. Utility services work coordination and monitoring service requests.
4. Commissioning activities.
5. Sustainability activities.

C. Electronic Safety and Security Preconstruction Conference: Schedule conference with Architect and Owner not later than [**10**]<**Insert number**> days after Notice to Proceed. Agenda topics include, but are not limited to, the following:

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1. Installation schedule for security, fire-alarm, and other life-safety systems.
2. Value analysis proposals and requests for substitution of electronic safety and security equipment.
3. Monitoring services work coordination and monitoring service requests.
4. Commissioning activities.
5. Sustainability activities.

1.3 ACTION SUBMITTALS

A. Coordination Drawings for Structural Supports: Show coordination of structural supports for equipment and devices, including restraints and bracing for control of seismic and wind loads, with other systems, equipment, and structural supports in the vicinity.

B. Coordination Drawings for Ceiling Areas: Where indicated on drawings, provide reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, in accordance with Section 013100 "Project Management and Coordination," on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which equipment and suspension systems will be attached.
3. Size and location of access panels on ceilings.
4. Elevation, size, and route of sprinkler piping.
5. Elevation, size, and route of plumbing piping.
6. Elevation, size, and route of ductwork.
7. Elevation, size, and route of cable tray.
8. Elevation, size, and route of conduit.
9. Elevation and size of wall-mounted and ceiling-mounted equipment.
10. Access panels.
11. Sprinklers.
12. Air inlets and outlets.
13. Control modules.
14. Luminaires.
15. Communications devices.
16. Speakers.
17. Security devices.
18. Fire-alarm devices.
19. Indicate clear dimensions for maintenance access in front of equipment.
20. Indicate dimensions of fully open access doors.

C. Coordination Drawings for Cable Tray Routing: Reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, in accordance with Section 013100 "Project Management and Coordination," on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Elevation, size, and route of cable trays.
2. Relationships between components and adjacent structural, electrical, and

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mechanical elements.

3. Vertical and horizontal offsets and transitions.
4. Elevation and size of sleeves for wall, ceiling, and floor cable penetrations.
5. Elevation of ceilings and size of ceiling tiles.
6. Locations of access panels on ceilings.
7. Locations where cable tray crosses or parallels sprinkler piping.
8. Locations where cable tray crosses plumbing piping.
9. Locations where cable tray crosses or parallels ductwork.
10. Locations of access panels on ductwork.
11. Locations where cable tray crosses conduit.
12. Items blocking access around cable trays, including the following:

    a. Light fixtures.
    b. Speakers.
    c. Fire-alarm devices.
    d. Power outlets.
    e. Wall-mounted equipment.
    f. Equipment racks.
    g. Furniture.
    h. Door swings.
    i. Building features.

13. Indicate clear dimension between cable tray and walls or obstructions that are closer than 10 ft.
14. Highlight locations where cable tray is greater than 3 ft above ceilings. Explain how personnel access will be accommodated for cable tray maintenance.

D. Coordination Drawings for Conduit Routing: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

E. Coordination Drawings for Bus Assembly Routing: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Scaled bus-assembly layouts and relationships between components and adjacent structural, mechanical, and electrical elements.
2. Vertical and horizontal enclosed bus-assembly runs, offsets, and transitions.
3. Clearances for access above and to the side of enclosed bus assemblies.
4. Vertical elevation of enclosed bus assemblies above the floor or bottom of structure.
5. Support locations, type of support, and weight on each support.
6. Location of adjacent construction elements, including luminaires, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

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F. Coordination Drawings for Large Equipment Indoor Installations:

1. Location plan, drawn to scale, showing heavy equipment or truck access paths to loading dock or other freight access into building. Indicate available width and height of doors or openings.
2. Floor plan for entry floor and floor where equipment is located, drawn to scale, showing heavy equipment access paths for maintenance and replacement, with the following items shown and coordinated with each other, based on input from installers of the items involved:

    a. Dimensioned concrete bases, outlines of equipment, conduit entries, and grounding equipment locations.
    b. If freight elevator must be used, indicate width and height of door and depth of car. Indicate if large equipment must be tipped to use elevator.
    c. Dimensioned working clearances and dedicated areas below and around electrical equipment where obstructions and tripping hazards are prohibited.

3. Reflected ceiling plans for entry floor and floor where equipment is located, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

    a. Support locations, type of support, and weight on each support. Locate structural supports for structure-supported raceways[**, busways,**][**and seismic bracing**].
    b. Location of lighting fixtures, sprinkler piping and sprinklers, ducts and diffusers, and other obstructions, indicating available overhead clearance.
    c. Dimensioned working clearances and dedicated areas above and around electrical equipment where foreign systems and equipment are prohibited.

G. Coordination Drawings for Large Equipment Outdoor Installations:

1. Utilities site plan, drawn to scale, showing heavy equipment or truck access paths for maintenance and replacement, with the following items shown and coordinated with each other, based on input from installers of the items involved:

    a. Fences and walls, dimensioned concrete bases, outlines of equipment, conduit entries, and grounding and bonding locations.
    b. Indicate clear dimensions for fence gates and wall openings.
    c. Indicate depth and type of ground cover, and locations of trees, shrubbery, and other obstructions in access path.
    d. Indicate clear height below tree branches, overhead lines, bridges, and other overhead obstructions in access path, or where cranes and hoists will be needed to handle large electrical equipment.
    e. Support locations, type of support, and weight on each support. Locate structural supports for structure-supported raceways[**, busways,**][**and seismic bracing**].
    f. Dimensioned working clearances and dedicated areas around electrical equipment.

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H. Coordination Drawings for Duct Banks:

1. Show duct profiles and coordination with other utilities and underground structures.
2. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

I. Sustainable Design Submittals:

1. Electrical Waste Management (Lamps): Provide documentation that an area has been provided to serve entire Project for collection and storage of fluorescent and HID lamps and ballasts for their appropriate disposal or recycling in accordance with jurisdictional hazardous waste requirements.
2. Electrical Waste Management (Electronics and Batteries): Provide documentation that an area has been provided to serve entire Project for collection and storage of electronics, alkaline batteries, and rechargeable batteries for their appropriate disposal or recycling in accordance with jurisdictional hazardous waste requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:

1. Submission of power system studies.
2. Submission of specified coordination drawings.
3. Submission of action submittals specified in Division 26.
4. Orders placed for major electrical equipment.
5. Arrival of major electrical equipment on-site.
6. Preinstallation meetings specified in Division 26.
7. Utility service outages.
8. Utility service inspection and activation.
9. Mockup reviews.
10. Closing of walls and ceilings containing electrical Work.
11. System startup, testing, and commissioning activities for major electrical equipment.
12. System startup, testing, and commissioning activities for emergency lighting.
13. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
14. Pouring of concrete housekeeping pads for electrical equipment and testing of concrete samples.
15. Requests for special inspections.
16. Requests for inspections by authorities having jurisdiction.

B. Installation Schedule for Communications Systems: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for installation of the communications Work to Owner and Architect including, but not limited to, milestone dates for the following activities:

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1. Submission of specified coordination drawings.
2. Submission of action submittals specified in Division 27.
3. Orders placed for major equipment.
4. Arrival of major equipment on-site.
5. Preinstallation meetings specified in Division 27.
6. Telephone and internet service outages.
7. Telephone and internet service inspection and activation.
8. Mockup reviews.
9. Closing of walls and ceilings containing the communications Work.
10. System startup, testing, and commissioning activities for communications equipment.
11. System startup, testing, and commissioning activities for the Work specified in other divisions that depends on the Work specified in Division 27.
12. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
13. Requests for special inspections.
14. Requests for inspections by authorities having jurisdiction.

C. Installation Schedule for Security, Fire-Alarm, and Other Life-Safety Systems: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for installation of security, fire-alarm, and the other life-safety Work to Owner and Architect including, but not limited to, milestone dates for the following activities:

1. Submission of specified coordination drawings.
2. Submission of action submittals specified in Division 28.
3. Orders placed for major equipment.
4. Arrival of major equipment on-site.
5. Preinstallation meetings specified in Division 28.
6. Security and fire-alarm system outages.
7. Security and fire-alarm system inspection and activation.
8. Mockup reviews.
9. Closing of walls and ceilings containing the security and fire-alarm Work.
10. System startup, testing, and commissioning activities for security and fire-alarm equipment.
11. System startup, testing, and commissioning activities for fire-alarm interfaces with the Work specified in other divisions.
12. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
13. Requests for special inspections.
14. Requests for inspections by authorities having jurisdiction.

D. Welding certificates.

E. Seismic Performance Certificates: Provide special certification for designated seismic systems as required to meet requirements specified in Section 018123 "Facility Seismic and Wind Criteria" for all designated seismic systems identified on the Drawings or in the Specifications.

1. Include the following information:

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a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
d. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
e. Equipment manufacturer's written certification for each designated active electrical seismic device and system, stating that it will remain operable following the basis-of-design seismic criteria specified in Section 018123 "Facility Seismic and Wind Criteria."
f. Equipment manufacturer's written certification that components with hazardous contents maintain containment following the basis-of-design seismic criteria specified in Section 018123 "Facility Seismic and Wind Criteria."
g. Evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by qualified structural professional engineer.

F. Wind Performance Certificates: Provide special certification for systems and components designated on the Drawings or in the Specifications to be subject to high wind exposure and impact damage.

1. Include the following information:

a. Provide equipment manufacturer's written certification for each designated system and component, stating that it will remain in place and operable following the design wind event and comply with requirements of authorities having jurisdiction.
b. Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

G. Qualification Statements:

1. For qualified regional manufacturer.
2. For structural professional engineer.
3. For electrical professional engineer.
4. For lighting professional engineer.
5. For EPM specialist.
6. For welder.
7. For ERMC-S-PVC raceway Installer.
8. For medium-voltage cable Installer.
9. For medium-voltage duct Installer.
10. For medium-voltage equipment Installer.
11. For electrical power monitoring Installer.
12. For switchboard Installer.
13. For EVSE Installer.
14. For generator set Installer.
15. For lightning protection system Installer.

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16. For theatrical lighting Installer.
17. For exterior athletic lighting Installer.
18. For power quality specialist.
19. For electrical testing and inspecting agency and its on-site electrical testing supervisor.
20. For structural testing and inspecting agency.
21. For outdoor pole testing and inspecting agency.
22. For luminaire photometric testing laboratory.
23. For lighting testing and inspecting agency.
24. For communications design professional.
25. For communications cable Installer.
26. For communications testing and inspecting agency and its on-site communications testing supervisor.
27. For nurse call/code blue system Installer.
28. For security design professional.
29. For fire-alarm system design professional.
30. For mass notification design professional.
31. For IB-PSC design professional.
32. For general radiotelephone operator license (GROL) designer.
33. For emergency communications design professional.
34. For fire-alarm cable Installer and its on-site fire-alarm cable installation supervisor.
35. For security testing and inspecting agency and its on-site security testing supervisor.
36. For intrusion detection systems installer.
37. For perimeter security systems integrator.
38. For fire-alarm testing agency and its on-site fire-alarm testing supervisor.
39. For detention electronics systems Installer.
40. For detention electronics systems integrator.
41. For detention electronics systems testing and inspecting agency.

1.5 CLOSEOUT SUBMITTALS

A. Facility EMP Binders:

1. Complete Set: On [**approved online or cloud solution**][**and**][**USB media that is clearly and permanently labeled with attached placard on lanyard to prevent misplacement**].
2. Volumes 2 and 8: Reproducible hardcopy on archival quality, 28 lb, acid-free, bond paper.

B. Operation and Maintenance Data:

1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:

   a. <**Insert system, equipment, or device**>.

2. Include the following information:

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a. Manufacturer's operating specifications.
b. User's guides for software and hardware.
c. Schedule of maintenance material items recommended to be stored at the Project site.
d. Detailed instructions covering operation under both normal and abnormal conditions.
e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.
f. List of load-current and overload-relay heaters with related motor nameplate data.
g. List of lamp types and photoelectric relays used on the Project, with ANSI and manufacturers' codes.
h. Manufacturer's instructions for setting field-adjustable components.
i. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.
j. EPSS: Manufacturer's system checklists, maintenance schedule, and maintenance log sheets in accordance with NFPA 110.
k. Exterior pole inspection and repair procedures.

C. Software and Firmware Operational Documentation: Provide software and firmware operational documentation[**in Facility EPM Binders**], including the following:

1. Software operating and upgrade manuals.
2. Names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.
5. Testing and adjusting of panic and emergency power features.
6. For lighting controls, include the following:

a. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
b. Operation of adjustable zone controls.

D. Software:

1. Program Software Backup: Provide [**username and password for approved online or cloud solution**][**and**][**USB media that is clearly and permanently labeled with attached placard on lanyard to prevent misplacement**].
2. Provide to Owner upgrades and unrestricted licenses[**for Government use**] for installed and backup software, including operating systems and programming tools required for operation and maintenance.

1.6 MOCKUPS

A. Simple Mockups for Coordinating Accessibility of Electrical Devices around Fixed Furnishings and Equipment:

1. Build simple mockups using art supplies and other inexpensive materials for verification of general arrangement, actual dimensions, and accessibility of <**Insert identification of room and fabrication**> by

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[Architect][Owner][Tenant]<Insert approving stakeholders> prior to fabrication and installation of Work. Depict products from all Divisions requiring coordination, including, but not limited to, fixed furnishings, casework, outlet covers and plates, HVAC controls, exposed raceway, exposed plumbing, equipment, and signage.

B. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 DEVELOPMENT OF FACILITY ELECTRICAL MAINTENANCE PROGRAM (EMP)

A. Facility EMP must be developed by qualified EMP specialist.

B. Conduct Facility EMP analysis in accordance with NFPA 70B requirements.

1. Renovation Projects:

a. Facility diagrams must include connected existing equipment for entire facility where known. Areas of uncertainty should be clearly indicated.
b. Obtain copies of existing operation and maintenance data and existing Facility EMP information from Owner.
c. Facility EMP analysis should identify existing equipment that does not have available operation and maintenance data, and should explain Owner's risks because this equipment is not included in Facility EMP.
d. Data for existing equipment outside scope of the Project may be inserted in Facility EMP Binders without analysis.
e. Data for existing equipment impacted by scope of the Project should be analyzed and documented similar to the Project's new equipment data as much as possible.

C. Compile operation and maintenance data from Facility EMP analysis and submit [updated] Facility EMP Binders.

3.2 INSTALLATION OF ELECTRICAL WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of electrical Work on the Project. Consult Architect for resolution of conflicting requirements.

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SECTION 260513 - MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fault indicators.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

B. Samples: 16 inch lengths for each type of cable specified.

C. Sustainable Design Submittals:

1. Product Data: For solvents and adhesives, indicating VOC content.
2. Laboratory Test Reports: For solvents and adhesives, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Indicate location of each cable, splice, and termination.

B. Material Certificates: For each type of cable and accessory.

C. Design Data: Cable pulling calculations, including conduit size and fill percentage, pulling tensions, cable sidewall pressure, jam probability, voltage drop, and ground wire sizing for each cable.

D. Source quality-control reports.

E. Field quality-control reports.

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PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2 and NFPA 70.

C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 SOURCE QUALITY CONTROL

A. Test and inspect cables according to [ICEA S-97-682][ICEA S-94-649] before shipping.

B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inch on the pull rope.

1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.

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3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. Install direct-buried cables on leveled and tamped bed of 3 inch thick, clean sand. Separate cables crossing other cables or piping by a minimum of 2 inch of tamped earth, plus an additional 2 inch of sand. Install permanent markers at ends of cable runs, changes in direction, and buried splices.

G. Install "buried-cable" warning tape 12 inch above cables.

H. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.

I. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.

J. Install cable splices at pull points and elsewhere as indicated; use standard kits.[**Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.**]

K. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.

L. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
3. Standoff Insulator: At each terminal junction, with one on each terminal.

M. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.
2. Wrap metallic cable components with 10 mil pipe-wrapping tape.
3. Smooth surface contours with electrical insulation putty.
4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
5. Band arc-proofing tape with two layers of 1 inch wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.

N. Seal around cables passing through fire-rated elements according to Section 078413

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"Penetration Firestopping."

O. Install fault indicators on each phase where indicated.

P. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

Q. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.

R. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.

B. Medium-voltage cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies basis-of-design environmental conditions and performance criteria that are applicable to product selection and installation of the Work on the Project.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components on the Project.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
4. Section 078413 "Penetration Firestopping" specifies materials and methods for sealing penetrations of rated walls and partitions referenced by this Section.
5. Section 260513 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 601 to 35 000 V.
6. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
7. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
8. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers, supports, and concrete bases referenced by this Section.
9. Section 260533.13 "Conduits for Electrical Systems" specifies installation of raceways referenced by this Section.
10. Section 260536 "Cable Trays for Electrical Systems" specifies cable tray installation referenced by this Section.
11. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" specifies installation of sleeves and sleeve seals referenced by this Section.
12. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
13. Section 271313 "Communications Copper Backbone Cabling" for twisted pair cabling used for data circuits.
14. Section 271513 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.2 ACTION SUBMITTALS

A. Product Schedule: Indicate type, use, location, and termination locations.

B. Product Data: For each type of product.

C. Sustainable Design Submittals:

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1. Product Data: For solvents and adhesives, indicating VOC content.

D. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

B. Field Reports:

1. Field reports for infrared scanning.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper, aluminum, or copper-clad aluminum for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Material: [**Copper**][**Aluminum**][**Copper-clad aluminum**].

a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
b. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

D. PV Circuits: [**Copper**][**Aluminum**][**Copper-clad aluminum**]; Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

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3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: [Type THHN/THWN-2, single conductors in raceway][Type XHHW-2, single conductors in raceway][Type USE, single conductor in raceway][Mineral-insulated, metal-sheathed cable, Type MI][Multiconductor cable, Type SE].

B. Exposed Feeders: [Type THHN/THWN-2, single conductors in raceway][Type XHHW-2, single conductors in raceway][Armored cable, Type AC][Metal-clad cable, Type MC][Mineral-insulated, metal-sheathed cable, Type MI][Nonmetallic-sheathed cable, Type NM].

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: [Type THHN/THWN-2, single conductors in raceway][Armored cable, Type AC][Metal-clad cable, Type MC][Mineral-insulated, metal-sheathed cable, Type MI][Nonmetallic-sheathed cable, Type NM].

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: [Type THHN/THWN-2, single conductors in raceway][Type XHHW-2, single conductors in raceway][Underground feeder cable, Type UF].

E. Feeders Installed below Raised Flooring: [Type THHN/THWN-2, single conductors in raceway][Armored cable, Type AC][Metal-clad cable, Type MC][Mineral-insulated, metal-sheathed cable, Type MI].

F. Feeders in Cable Tray: [Type THHN/THWN-2, single conductors in raceway][Type XHHW-2, single conductors larger than No. 1/0 AWG][Armored cable, Type AC][Metal-clad cable, Type MC][Mineral-insulated, metal-sheathed cable, Type MI][Nonmetallic-sheathed cable, Type NM].

G. Exposed Branch Circuits, Including in Crawlspaces: [Type THHN/THWN-2, single conductors in raceway][Armored cable, Type AC][Metal-clad cable, Type MC][Mineral-insulated, metal-sheathed cable, Type MI][Nonmetallic-sheathed cable, Type NM].

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: [Type THHN/THWN-2, single conductors in raceway][Armored cable, Type AC][Metal-clad cable, Type MC][Mineral-insulated, metal-sheathed cable, Type MI][Nonmetallic-sheathed cable, Type NM].

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: [Type THHN/THWN-2, single conductors in raceway][Type XHHW-2, single conductors in raceway][Underground branch-circuit cable, Type UF].

J. Branch Circuits Installed below Raised Flooring: [Type THHN/THWN-2, single conductors in raceway][Armored cable, Type AC][Metal-clad cable, Type MC][Mineral-insulated, metal-sheathed cable, Type MI].

K. Branch Circuits in Cable Tray: [Type THHN/THWN-2, single conductors in raceway][Type XHHW-2, single conductors larger than No. 1/0 AWG][Armored cable, Type AC][Metal-clad cable, Type MC][Mineral-insulated, metal-sheathed cable, Type MI][Nonmetallic-sheathed cable, Type NM].

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L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

M. ASD Output Circuits: [**Type XHHW-2 in metal conduit**][**Type TC-ER cable with braided shield**][**Type TC-ER cable with dual tape shield**].

N. PV Circuits, Type USE-2: For PV source circuits rated at 600 V or less.

O. PV Circuits, Type PV: For PV source circuits rated at [**600**][**1000**][**2000**] V.

3.3 INSTALLATION OF LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Maintenance: NFPA 70B.
3. Electrical Safety: NFPA 70E.
4. Temporary Electric Power Work: NECA NEIS 200.
5. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
6. Work in Confined Spaces: NFPA 350.
7. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
8. Installation of Type AC and Type MC Cables: NECA NEIS 120.
9. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
2. Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables.
3. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
4. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
5. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
6. Provide support for cables.
7. Complete cable tray systems installation prior to installing conductors and cables.
8. Connections:

a. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

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b. Make splices, terminations, and taps that are compatible with conductor material[**and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors**].

1) Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

9. Wiring at Outlets: Install conductor at each outlet, with at least [6 inch][12 inch] of slack.

D. Interfaces with Other Work:

1. Identification:

a. Identify and color-code conductors and cables.
b. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

2. Sleeves and Sleeve Seals: Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.
3. Firestopping: Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.4 FIELD QUALITY CONTROL

A. Administrant for Electrical Power Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

B. Acceptance Testing Preparation:

1. <**Insert requirements**>.

C. Field tests and inspections must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

D. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

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3. After installing conductors and cables and before electrical circuitry has been energized, test [**service entrance and feeder conductors**][**and**][**conductors**] feeding the following critical equipment and services for compliance with requirements:

    a. <**Insert, in separate subparagraphs, critical equipment and services to be tested**>.

4. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection in accordance with the single-line diagram.
    b. Test bolted connections for high resistance using one or more of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

E. Nonconforming Work:

1. Wire or cable assembly will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

F. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.5 MAINTENANCE

A. Infrared Scanning of Splices: Two months after Substantial Completion, perform infrared scan of splices, joints, and connections in conductors 3 AWG and larger. Remove covers so splices, joints, and connections are accessible to portable scanner. Take visible light photographs at same locations and orientations as infrared scans for documentation to ensure follow-on scans match same conditions for valid comparison. Correct deficiencies determined during the scan.

1. Follow-On Infrared Scanning: Perform follow-up infrared scan of splices at 11 months after Substantial Completion.
2. Instrument: Use infrared-scanning device designed to measure temperature or to

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detect significant deviations from normal values. Provide documentation of device calibration.

3. Field Reports for Infrared Scanning: Prepare certified report that identifies cables splices checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION 260519

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies basis-of-design environmental conditions and performance criteria that are applicable to product selection and installation of the Work on the Project.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components on the Project.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
4. Section 264113 "Lightning Protection for Structures" specifies bonding of lightning protection grounding electrodes to facility grounding electrodes.
5. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
6. Section 270528 "Pathways for Communications Systems"[**and Section 271100 "Communications Equipment Room Fittings"**] specifies additional requirements for identification and grounding and bonding of communications equipment, raceways, boxes, and cable trays.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

    a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
    b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
    c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are unacceptable for submitted product.

B. Shop Drawings: Prepare and submit the following:

1. Plans showing dimensioned locations of grounding features described in "Field Quality Control for Grounding and Bonding" Article, including the following:

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a. Grounding electrode access enclosures.
b. Grounding electrodes.
c. Grounding arrangements and connections for separately derived systems.
d. <Insert items>.

C. Sustainable Design Submittals:

1. Product data for sustainable design features for each type of product.

D. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. In addition to items specified in Section 260010 "Supplemental Requirements for Electrical," include the following:

a. Plans showing locations of grounding features described in "Field Quality Control for Grounding and Bonding" Article, including the following:

1) Grounding electrode access enclosures.
2) Grounding electrodes.
3) Grounding arrangements and connections for separately derived systems.
4) <Insert items>.

b. Instructions for periodic testing and inspection of grounding features at [test wells][ring electrodes][grounding connections for separately derived systems]<Insert locations> based on [NETA MTS][NFPA 70B]<Insert reference>.

1) Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
2) Include recommended testing intervals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having

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jurisdiction, and marked for intended location and application.

B. <Insert additional performance requirements for the Project>.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING AND BONDING

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Maintenance: NFPA 70B.
3. Electrical Safety: NFPA 70E.
4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
5. Communications Work: BICSI N1.
6. Work in ITE Rooms: NFPA 75.
7. Work in Health Care Facilities: NFPA 99 and Article 517 of NFPA 70.
8. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
9. Work in Confined Spaces: NFPA 350.
10. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
11. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
12. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

1. Grounding and Bonding Conductors:

   a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
   b. Underground Grounding Conductors:

      1) Bury at least 30 inch below grade.
      2) Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.

2. Grounding and Bonding Connectors: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

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a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
b. Make connections with clean, bare metal at points of contact.
c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.

g. Grounding and Bonding for Piping:

1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.
3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

h. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install [**tinned**]bonding jumper to bond across flexible duct connections to achieve continuity.
i. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than **60 ft** apart.

3. Grounding and Bonding Busbars:

a. Install busbar horizontally, on insulated spacers **2 inch** minimum from wall, **6 inch** above finished floor unless otherwise indicated.
b. Where busbars are indicated on both sides of doorways, route bonding conductor up to top of door frame, across top of doorway, and down;

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connect to continuation of horizontal busbar.

4. Electrodes:

   a. Ground Rods: Drive rods until tops are 2 inch below finished floor or final grade unless otherwise indicated.

      1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
      2) Use exothermic welds for below-grade connections.

   b. For grounding electrode system, install at least [three]<Insert number> rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.
   c. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and must be at least 12 inch deep, with cover.

      1) Install at least one test well for each service unless otherwise indicated. Install at ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

   d. Ring Electrode: Install grounding conductor, electrically connected to each building structure ground rod and to each [steel column][indicated item], extending around perimeter of [building][area or item indicated].

      1) Install tinned-copper conductor not less than [2/0 AWG]<Insert wire size> for ring electrode and for taps to building steel.
      2) Bury ring electrode not less than [24 inch]<Insert dimension> from building's foundation.

   e. Concrete-Encased Electrode (Ufer Ground):

      1) Fabricate in accordance with NFPA 70; use minimum of [20 ft]<Insert dimension> of bare copper conductor not smaller than [4 AWG]<Insert wire size>.

         a) If concrete foundation is less than [20 ft]<Insert dimension> long, coil excess conductor within base of foundation.
         b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

      2) Fabricate in accordance with NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft long. If reinforcing is in multiple pieces, connect together by usual steel tie wires or exothermic welding to create required length.

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5. Grounding at Service:

    a. Equipment grounding conductors and grounding electrode conductors must be connected to ground busbar. Install main bonding jumper between neutral and ground buses.

6. Grounding Separately Derived Systems:

    a. Permanent Generators: Install grounding electrode(s) at location of permanent generators having switched neutral connections. Electrode must be connected to equipment grounding conductor and to frame of generator.

7. Grounding Underground Distribution System Components:

    a. Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.
    b. Comply with IEEE C2 grounding requirements.
    c. Grounding Manholes and Handholes: Install driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch will extend above finished floor. If necessary, install ground rod before manhole is placed and provide 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch above to 6 inch below concrete. Seal floor opening with waterproof, nonshrink grout.
    d. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields in accordance with manufacturer's published instructions with splicing and termination kits.
    e. Pad-Mounted Transformers and Switches: Install two ground rods and ring electrode around pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than 2 AWG for ring electrode and for taps to equipment grounding terminals. Bury ring electrode not less than 6 inch from foundation.

8. Equipment Grounding and Bonding:

    a. Install insulated equipment grounding conductors with feeders and branch circuits.
    b. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

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1) Feeders and branch circuits.
2) Lighting circuits.
3) Receptacle circuits.
4) Single-phase motor and appliance branch circuits.
5) Three-phase motor and appliance branch circuits.
6) Flexible raceway runs.
7) Armored and metal-clad cable runs.
8) Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9) X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

c. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
d. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
e. Isolated Grounding Receptacle Circuits: Install insulated equipment grounding conductor connected to receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.
f. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.
g. Poles Supporting Outdoor Lighting Fixtures: Bond insulated equipment grounding conductor to equipment grounding terminal inside pole base.
h. Metallic Fences: Comply with requirements of IEEE C2.

1) Grounding Conductor: Bare[, **tinned**] copper, not less than [**8 AWG**]<**Insert wire size**>.
2) Gates: Must be bonded to grounding conductor with flexible bonding jumper.
3) Barbed Wire: Strands must be bonded to grounding conductor.

9. Fence Grounding:

a. Grounding Method: At each grounding location, drive grounding rod vertically until top is **6 inch** below finished grade. Connect rod to fence with 6 AWG conductor. Connect conductor to each fence component at grounding location.

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b. Fences greater than 100 ft of Buildings, Structures, Walkways, and Roadways: Ground fence at maximum intervals of [1500 ft]<**Insert lesser distance if grounding resistance is high**>.
c. Fences within 100 ft of Buildings, Structures, Walkways, and Roadways: Ground fence at maximum intervals of [750 ft]<**Insert lesser distance if grounding resistance is high**>.

1) Gates and Other Fence Openings: Ground fence on each side of opening.

a) Bond metal gates to gate posts by connecting bonding jumper between gate post and gate frame.
b) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use 2 AWG wire and bury it at least 18 inch below finished grade.

d. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of power line crossing and at maximum distance of 150 ft on each side of crossing.
e. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground fence and bond fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.2 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING

A. Administrant for Electrical Power Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

B. Acceptance Testing Preparation:

1. <**Insert requirements**>.

C. Field tests and inspections must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted,

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electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.

3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal[, at ground test wells][, and at individual ground rods]. Make tests at ground rods before conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method in accordance with IEEE Std 81.
    c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to record of tests and observations. Include number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Nonconforming Work:

1. Grounding system will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective components and retest.

F. Collect, assemble, and submit test and inspection reports.

1. Report measured ground resistances that exceed the following values:

    a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: [10 Ω]<Insert ohms>.
    b. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: [5 Ω]<Insert ohms>.
    c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: [3 Ω]<Insert ohms>.
    d. Power Distribution Units or Panelboards Serving Electronic Equipment: [1 Ω][3 Ω]<Insert ohms>.
    e. Substations and Pad-Mounted Equipment: [5 Ω]<Insert ohms>.
    f. Manhole Grounds: [10 Ω]<Insert ohms>.
    g. <Insert application and maximum ground-resistance>.

END OF SECTION 260526

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installation of fabricated metal supports.
2. Installation of concrete bases.

B. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies basis-of-design environmental conditions and performance criteria that are applicable to product selection and installation of the Work on the Project.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components on the Project.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
4. Section 033000 "Cast-in-Place Concrete" specifies concrete materials, reinforcement, and placement requirements referenced by this Section.
5. Section 055000 "Metal Fabrications" specifies site-fabricated metal supports referenced by this Section.
6. [**Section 099113 "Exterior Painting"**][**Section 099123 "Interior Painting"**][**and**][**Section 099600 "High-Performance Coatings"**] specify cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal referenced by this Section.
7. Section 260548 "Vibration and Seismic Controls for Electrical Systems" specifies vibration controls, seismic restraints, and wind restraints referenced by this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.

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h. Saddles.
i. Brackets.
j. <Insert product type>.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated Design Submittals: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.
2. Include design calculations for seismic restraints.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Prepare design calculations in accordance with criteria specified in Section 260010 "Supplemental Requirements for Electrical" and Section 018123 "Facility Seismic and Wind Criteria."

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements

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are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Hot Work: NFPA 51B.
3. Work in Confined Spaces: NFPA 350.
4. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
5. Installation of Steel Conduit: NECA NEIS 101.
6. Installation of Aluminum Conduit: NECA NEIS 102.
7. Installation of Metal Cable Tray Systems: NECA NEIS 105.
8. Installation of Nonmetallic Cable Tray Systems: NECA NEIS 111.
9. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Raceway Support Methods: In addition to methods described in NECA NEIS 1, [**EMT**][**IMC**][**and**][**ERMC**] may be supported by openings through structure members, in accordance with NFPA 70.
2. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus **200 lb**.
3. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

    a. To Wood: Fasten with lag screws or through bolts.
    b. To New Concrete: Bolt to concrete inserts.
    c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
    d. To Existing Concrete: Expansion anchor fasteners.
    e. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4 inch** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inch** thick.
    f. To Steel: [**Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts**][**Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69**][**Spring-tension clamps**].
    g. To Light Steel: Sheet metal screws.
    h. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate[**by means that comply with seismic-restraint strength and anchorage requirements**].

4. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

D. Interfaces with Other Work:

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1. Provide [vibration][and][seismic] controls with hangers and supports.
2. Touchup Finishes:

    a. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

        1) Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

    b. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
    c. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3. Installation of Fabricated Metal Supports:

    a. Provide site-fabricated metal supports.
    b. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
    c. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

4. Installation of Concrete Bases:

    a. Provide concrete bases of dimensions indicated, but not less than 4 inch larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
    b. Use [3000 psi]<Insert value>, 28-day compressive-strength concrete.
    c. Anchor equipment to concrete base as follows:

        1) Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
        2) Install anchor bolts to elevations required for proper attachment to supported equipment.
        3) Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 260529

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SECTION 260533.23 - SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies temperature, humidity, acoustical, and other field conditions applicable to the Work specified in this Section.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies seismic hazard, wind hazard, and other structural design conditions applicable to the Work specified in this Section.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
4. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
5. Section 260553 "Identification for Electrical Systems" specifies warning signs referenced by this Section.
6. Section 270528 "Pathways for Communications Systems"[and Section 271100 "Communications Equipment Room Fittings"] specifies additional requirements for identification of communications equipment and cabling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of product requiring samples for source quality control.

C. Sustainable Design Submittals:

1. Product data for sustainable design features for each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
4. Communications Work: BICSI N1.
5. Work in Confined Spaces: NFPA 350.
6. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
7. Auxiliary Gutters: Article 366 of NFPA 70.
8. Surface Metal Raceway: Article 386 of NFPA 70.
9. Surface Nonmetallic Raceway: Article 388 of NFPA 70.
10. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Install surface raceways only where indicated on Drawings.
2. Install surface raceway with a minimum 2 inch radius control at bend points.
3. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's published instructions. Tape and glue are unacceptable support methods.
4. **<Insert more stringent installation requirements that supplement or supersede listed standards and manufacturers' published instructions>**.

D. Interfaces with Other Work:

1. Identification: Provide labels for surface raceways and associated electrical equipment.

a. Identify field-installed conductors, interconnecting wiring, and components.
b. Provide warning signs.

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2. Coordinate installation of new products for <**Insert system or product family/category**> with existing conditions.

    a. <**Insert requirements for transition between new and existing**>.

3. Coordinate with <**Insert Section number and title**> for <**Insert description of interfacing related Work**>.

    a. <**Insert requirements for transition between this Section and related Work**>.

3.2 FIELD QUALITY CONTROL OF SURFACE RACEWAYS

A. Administrant for Electrical Power Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified medium-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified medium-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

B. Administrant for Communications Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified communications testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified communications testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

C. Field tests and inspections must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

D. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Perform tests and inspections recommended by standards listed in "Reference Standards for Installation" Paragraph.

E. Nonconforming Work:

1. Boxes and covers will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

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F. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

END OF SECTION 260533.23

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies basis-of-design environmental conditions and performance criteria that are applicable to product selection and installation of the Work on the Project.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components on the Project.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
4. Section 284600 "Fire Detection and Alarm"[**and Section 284614 "Single- and Multiple-Station Alarms"**] specifies fire detection and alarm devices referenced in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SELECTION OF IDENTIFICATION PRODUCTS FOR COMMUNICATIONS, CONTROL, AUXILIARY, AND LIFE SAFETY SYSTEMS

A. Comply with Section 270528 "Pathways for Communications Systems" and Section 271100 "Communications Equipment Room Fittings."

3.2 INSTALLATION

A. Install identification materials and devices at locations for most convenient viewing

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without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes typical for electrical equipment environments specified in Section 018116 "Facility Environmental Requirements" and Section 260010 "Supplemental Requirements for Electrical."

C. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

D. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

E. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

F. Install identifying devices before installing acoustical ceilings and similar concealment.

G. Verify identity of item before installing identification products.

H. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

I. Apply identification devices to surfaces that require finish after completing finish work.

J. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.

L. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.

M. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.

N. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.

O. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.

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P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.

Q. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

R. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.

U. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape not less than 12 inch directly above cables or raceways buried 18 inch or more below grade. Use multiple tapes where width of multiple lines installed in common trench [**or concrete envelope**]exceeds 16 inch overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

V. Concrete Cable Route Markers: [**As indicated on Drawings**]<**Insert Project-specific requirements**>.

W. Metal Tags:

1. Place in location with high visibility and accessibility.
2. Secure using [**general-purpose**][**UV-stabilized**][**plenum-rated**] cable ties.

X. Nonmetallic Preprinted Tags:

1. Place in location with high visibility and accessibility.
2. Secure using [**general-purpose**][**UV-stabilized**][**plenum-rated**] cable ties.

Y. Write-on Tags:

1. Place in location with high visibility and accessibility.
2. Secure using [**general-purpose**][**UV-stabilized**][**plenum-rated**] cable ties.

Z. Baked-Enamel Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

AA. Metal-Backed Butyrate Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

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BB. Laminated Acrylic or Melamine Plastic Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

END OF SECTION 260553

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SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies temperature, humidity, acoustical, and other field conditions applicable to the Work specified in this Section.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies seismic hazard, wind hazard, other structural design conditions applicable to the Work specified in this Section.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
4. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding of lighting control devices referenced by this Section.
5. Section 260529 "Hangers and Supports for Electrical Systems" specifies hangers and supports referenced by this Section.
6. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
7. [Section 262726 "Wiring Devices"][Section 262726.11 "General-Use Switches, Dimmer Switches, and Fan-Speed Controller Switches"] for wall-box dimmers and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

    a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
    b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
    c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are unacceptable for submitted product.

2. Include manufacturer's sample extended warranty language.

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B. Shop Drawings: Prepare and submit the following:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

1. ASHRAE/IES 90.1 LPD Compliance Documentation: Prepare plans and calculations demonstrating that as-constructed lighting power density complies with mandatory provisions of ASHRAE/IES 90.1 and that as-constructed lighting, including daylighting and controls, improves on baseline energy performance. If included with Project, indicate locations of energy meters for lighting loads.
2. Lighting Control Documentation: Floor plans indicating the following information:

a. As-installed locations of switches and dimmers.
b. Lighting zones and control strategy for each switch or dimmer, including unoccupied time-delay setting for shut-off and override time-delay setting for shut-off.
c. Multilevel or dimming range capability for each switch or dimmer.
d. Which switches or dimmers are operated by occupancy sensors, vacancy sensors, daylighting sensors, or time clocks.

D. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

B. Field Reports:

1. Manufacturer's field reports for field quality-control support.
2. Field reports for software and firmware upgrades.

1.4 CLOSEOUT SUBMITTALS

A. Warranty documentation.

B. Software and firmware service agreement.

1.5 WARRANTY

A. Special Installer Extended Warranty: Installer warrants that installed lighting control devices perform in accordance with specified requirements and agrees to repair or

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replace components or products that fail to perform as specified within extended-warranty period. Warranty must convey to Owner upon acceptance of the Work.

1. Extended-Warranty Period: [**Two**][**Three**][**Four**]<**Insert number**> years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that lighting control devices perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period. Warranty must convey to Owner upon acceptance of the Work.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.
c. <**Insert failure modes**>.

2. Initial Extended-Warranty Period: [**Three**][**Four**][**Five**]<**Insert number**> years from date of Substantial Completion; [**full**][**prorated**] coverage for labor, materials, and equipment.
3. Follow-On Extended-Warranty Period: [**Eight**]<**Insert number**> years from date of Substantial Completion; [**full**][**prorated**] coverage for materials only, free on board [**origin**][**destination**], freight prepaid.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements:

1. Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Must comply with CCR Title 24.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING CONTROL DEVICES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS

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1.
2. Electrical Maintenance: NFPA 70B.
3. Electrical Safety: NFPA 70E.
4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
5. Communications Work: BICSI N1.
6. Life Safety and Means of Egress Work: NFPA 101.
7. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
8. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
2. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.
3. Installation of Industrial Control Switches: Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.
4. Installation of Wiring:

   a. Conduit: Minimum conduit size is 1/2 inch.
   b. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's published instructions.
   c. Size conductors in accordance with lighting control device manufacturer's published instructions unless otherwise indicated.
   d. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

D. Interfaces with Other Work:

1. Identification: Provide labels for lighting control devices and associated electrical equipment.

   a. Identify field-installed conductors, interconnecting wiring, and components.
   b. Label each enclosure with engraved metal or laminated-plastic nameplate.
   c. Identify controlled circuits in lighting contactors.
   d. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
   e. Label time switches and contactors with a unique designation.

3.2 FIELD QUALITY CONTROL

A. Administrant for Electrical Power Tests and Inspections:

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1. [**Owner**][**Tenant**] will engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

B. Administrant for Lighting Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified lighting testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified lighting testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

C. Field tests must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

D. Tests and Inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Nonconforming Work:

1. Lighting control devices will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

F. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

G. Manufacturer Services: Engage factory-authorized service representative to [**support**][**supervise**] field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at the Project site.

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3.3 MAINTENANCE

A. Software and Firmware Service Agreement:

1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement includes software support for [two]<Insert number> years.
2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software upgrades that become available within [two]<Insert number> years from date of Substantial Completion. Verify upgrading software includes operating system and new or revised licenses for using software.

    a. Upgrade Notice: Not less than [30 days]<Insert duration>; to allow Owner to schedule and access the system[and to upgrade computer equipment if necessary].

3. Field Reports for Software and Firmware Upgrades: Prepare and submit report after each update, documenting upgrades installed.

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SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Installed, but Not Furnished, under This Section:

1. <**Insert products identified in "Existing Products to be Modified" Article or "Existing Products to be Removed and Reinstalled" Article**>.

B. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies temperature, humidity, acoustical, and other field conditions applicable to the Work specified in this Section.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies seismic hazard, wind hazard, other structural design conditions applicable to the Work specified in this Section.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional abbreviations, definitions, submittals, qualifications, testing agencies, and other requirements applicable to the Work for electrical, communications, and electronic safety and security systems on Project, including wiring methods.
4. Section 260529 "Hangers and Supports for Electrical Systems" specifies concrete bases and supports for panelboards installed by this Section.
5. Section 260548 "Vibration and Seismic Controls for Electrical Systems" specifies seismic control devices, mounting devices, and anchoring devices installed by this Section.
6. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
7. Section 260573 "Power System Studies" specifies short-circuit current studies, overcurrent protective device coordination studies, and arc-flash hazard analysis studies.
8. Section 260913 "Electrical Power Monitoring" specifies power monitoring and control systems installed by this Section.
9. Section 262813 "Fuses" specifies fuses and spare-fuse cabinets installed by this Section.
10. Section 264313 "Surge Protective Devices for Low-Voltage Electrical Power Circuits" specifies Type 1 and Type 2 surge protective devices installed by this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. In addition to information identified in Section 013300 "Submittal Procedures," submit the following:

1. Product Listing: Include copy of unexpired approval letter, on letterhead of

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qualified electrical testing agency, certifying product's compliance with specified listing criteria.
2. Include manufacturer's sample extended warranty language.

B. Shop Drawings: For each panelboard and related equipment:

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series rating of installed devices.
7. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include Internet link for electronic access to downloadable PDF of coordination curves.

C. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards.[**Submit final versions after load balancing.**]

B. Manufacturer's published instructions.

C. Field Reports:

1. Manufacturer's field reports for field quality-control support.
2. Field reports for voltage monitoring and adjusting.
3. Field reports for infrared scanning.

1.4 CLOSEOUT SUBMITTALS

A. Warranty documentation.

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1.5 WARRANTY

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed panelboards perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: [**Two**]<**Insert number**> years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that panelboards perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.

1. Initial Extended-Warranty Period: [**Three**][**Four**]<**Insert number**> years from date of Substantial Completion; [**full**][**prorated**] coverage for labor, materials, and equipment.
2. Follow-On Extended-Warranty Period: [**Five**]<**Insert number**> years from date of Substantial Completion; [**full**][**prorated**] coverage for materials[**that failed because of transient voltage surges**] only, free on board [**origin**][**destination**], freight prepaid.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Fabricate and test panelboards in accordance with IEEE 344 to withstand seismic forces specified in Section 018123 "Facility Seismic and Wind Criteria."

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Comply with NEMA PB 1.

E. Enclosures: [**Flush**][**and**][**Surface**]-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: UL 50E, [**Type 1**]<**Insert type**>.
b. Outdoor Locations: UL 50E, [**Type 3R**]<**Insert type**>.
c. Kitchen and Wash-Down Areas: UL 50E, [**Type 4X**]<**Insert type**>, [**stainless steel**]<**Insert material**>.
d. Other Wet or Damp Indoor Locations: UL 50E, [**Type 4**]<**Insert type**>.

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e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: UL 50E, [**Type 5**][**Type 12**].

2. Height: **7 ft** maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims must cover live parts and may have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims must cover live parts and may have no exposed hardware.
5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

   a. Panels and Trim: [**Steel**][**and**][**galvanized steel**], factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: [**Galvanized steel**][**Same finish as panels and trim**].
   c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

F. Phase, Neutral, and Ground Buses:

1. Material: [**Tin-plated aluminum**][**Hard-drawn copper, 98 percent conductivity**].

   a. Plating must run entire length of bus.
   b. Bus must be fully rated for entire length.

2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: [**Tin-plated aluminum**][**Hard-drawn copper, 98 percent conductivity**].
2. Terminations must allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: [**Compression**][**Mechanical**] type, with lug on neutral bar for each pole in panelboard.
5. Ground Lugs and Bus-Configured Terminators: [**Compression**][**Mechanical**] type, with lug on bar for each pole in panelboard.

H. Quality-Control Label: Panelboards or load centers must be labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers must have meter enclosures, wiring,

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connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

I. Future Devices: Panelboards or load centers must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: [5][10][20]<Insert number> percent.

J. Panelboard Short-Circuit Current Rating:

1. Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by qualified electrical testing laboratory recognized by authorities having jurisdiction. Include label or manual with size and type of allowable upstream and branch devices listed and labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series-connected short-circuit rating.

a. Panelboards rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
b. Panelboards rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.

2. Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for 100 percent interrupting capacity.

a. Panelboards and overcurrent protective devices rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
b. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with [NECA 407][NEMA PB 1.1].
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

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1. Equipment Mounting:

    a. Install floor-mounted panelboards on cast-in-place concrete equipment base(s).
    b. Attach panelboard to vertical finished or structural surface behind panelboard.
    c. Mount surface-mounted panelboards to steel slotted supports [5/8 inch][1-1/4 inch] in depth. Orient steel slotted supports vertically.
    d. Provide seismic control devices.

2. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
3. Provide mounting and anchoring devices.
4. Mount top of trim [7.5 ft]<**Insert height**> above finished floor unless otherwise indicated.
5. Mount panelboard cabinet plumb and rigid without distortion of box.
6. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
7. Install overcurrent protective devices and controllers not already factory installed.

    a. Set field-adjustable, circuit-breaker trip ranges.
    b. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.

8. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
9. Install filler plates in unused spaces.
10. Stub four 1 inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in future. Stub four 1 inch empty conduits into raised floor space or below slab not on grade.
11. Arrange conductors in gutters into groups and bundle and wrap with wire ties[**after completing load balancing**].
12. Mount spare fuse cabinet in accessible location.

D. Interfaces with Other Work:

1. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

3.2 FIELD QUALITY CONTROL

A. Administrant for Low-Voltage Electrical Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified low-voltage electrical testing and inspecting agency to administer and perform tests and inspections.

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2. Engage qualified low-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Field tests and inspections must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers[**and low-voltage surge arrestors**] stated in NETA ATS, Paragraph 7.6 Circuit Breakers[**and Paragraph 7.19.1 Surge Arrestors, Low-Voltage**]. [**Do not perform**][**Perform**] optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Nonconforming Work:

1. Panelboards will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

F. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

1. Include certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies

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detected, remedial action taken, and observations after remedial action.

G. Manufacturer Services: Engage factory-authorized service representative to [**support**][**supervise**] field tests and inspections.

END OF SECTION 262416

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Installed, but Not Furnished, under This Section:

1. <**Insert products identified in "Existing Products to be Modified" Article or "Existing Products to be Removed and Reinstalled" Article**>.

B. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies temperature, humidity, acoustical, and other field conditions applicable to the Work specified in this Section.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies seismic hazard, wind hazard, and other structural load design conditions applicable to the Work specified in this Section.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional coordination, scheduling, sequencing, submittal, and installation requirements applicable to the Work for electrical, communications, and electronic safety and security systems on the Project, including wiring methods.
4. [**Section 013100 "Project Management and Coordination"**]<**Insert Section number and title**> for preinstallation conference procedures.
5. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
6. Section 260533.16 "Boxes and Covers for Electrical Systems" specifies covers and cover plates referenced by this Section.
7. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.
8. Section 260923 "Lighting Control Devices" for occupancy sensors, timers, control-voltage switches, and control-voltage dimmers.
9. Section 260936 "Modular Dimming Controls" for multiscene and multipreset dimming controls.
10. Section 260943.16 "Addressable Luminaire Lighting Controls" for network lighting control solid-state devices.
11. Section 260943.23 "Relay-Based Lighting Controls" for network lighting control relay devices.
12. Section 262726.11 "General-Use Switches, Dimmer Switches, and Fan-Speed Controller Switches" for additional wiring device products.
13. Section 262726.31 "General-Grade Single Straight-Blade Receptacles" for additional wiring device products.
14. Section 262726.33 "General-Grade Duplex Straight-Blade Receptacles" for additional wiring device products.
15. Section 262726.35 "Hospital-Grade Straight-Blade Receptacles" for additional wiring device products.
16. Section 262726.37 "Receptacles with Arc-Fault and Ground-Fault Protective

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Devices" for additional wiring device products.
17. Section 262726.39 "Locking Receptacles" for additional wiring device products.
18. Section 262726.41 "Pin-and-Sleeve Receptacles" for additional wiring device products.
19. Section 262726.43 "Special-Purpose Power Outlet Assemblies" for additional wiring device products.
20. Section 262726.51 "Connectors, Cords, and Plugs" for additional wiring device products.
21. Section 270528 "Pathways for Communications Systems"[**and Section 271100 "Communications Equipment Room Fittings"**] specifies additional requirements for raceway materials, routing, locations, and identification of communications equipment and cabling.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**]<**Insert location**>.

B. Preinstallation Coordination Meeting(s): For ceiling-mounted cable reels. Conduct meeting [**as videoconference**][**or**][**at Project site**]<**Insert location**> before <**Insert construction activity**>.

1. Attendees: Installers, fabricators, representatives of manufacturers, and administrants for field tests and inspections. Notify Architect[**, Construction Manager**][**, and Owner's Commissioning Authority**] of scheduled meeting dates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are not acceptable for submitted product.

2. Include manufacturer's sample extended warranty language.

B. Samples:

1. One for each kind of toggle switch[**and cover plate accessory**] specified, in each finish and color specified.

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2. One for each kind of key lock switch[and cover plate accessory] specified, in each finish and color specified.
3. One for each kind of maintained-contact switch[and cover plate accessory] specified, in each finish and color specified.
4. One for each kind of momentary-contact switch[and cover plate accessory] specified, in each finish and color specified.
5. One for each kind of rocker switch[and cover plate accessory] specified, in each finish and color specified.
6. One for each kind of dimmer switch[and cover plate accessory] specified, in each finish and color specified.
7. One for each kind of fan-speed controller switch[and cover plate accessory] specified, in each finish and color specified.
8. One for each kind of single straight-blade receptacle[and cover plate accessory] specified, in each finish and color specified.
9. One for each kind of duplex straight-blade receptacle[and cover plate accessory] specified, in each finish and color specified.
10. One for each kind of duplex straight-blade receptacle with integral switching means[and cover plate accessory] specified, in each finish and color specified.
11. One for each kind of hospital-grade straight-blade receptacle[and cover plate accessory] specified, in each finish and color specified.
12. One for each kind of receptacle with AFCI device[and cover plate accessory] specified, in each finish and color specified.
13. One for each kind of receptacle with AFCI and GFCI devices[and cover plate accessory] specified, in each finish and color specified.
14. One for each kind of receptacle with GFCI device[and cover plate accessory] specified, in each finish and color specified.
15. One for each kind of locking receptacle[and cover plate accessory] specified, in each finish and color specified.
16. One for each kind of pin-and-sleeve receptacle specified, in each finish and color specified.
17. One for each kind of cord connector specified, in each finish and color specified.

C. Shop Drawings:

1. Wiring diagrams for duplex straight-blade receptacles with integral switching means.

D. Sustainable Design Submittals:

1. Product data for sustainable design features for each type of product.
2. Lighting Control Documentation: Floor plans indicating the following information:

    a. As-installed locations of switches and dimmers.
    b. Lighting zones and control strategy for each switch or dimmer, including unoccupied time-delay setting for shut-off and override time-delay setting for shut-off.
    c. Multilevel or dimming range capability for each switch or dimmer.
    d. Which switches or dimmers are operated by occupancy sensors, vacancy sensors, daylighting sensors, or time clocks.

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3. Record floor plan Drawings indicating as-installed locations of switches and dimmers, indicating lighting zone's each device control, to verify extent of ability of the installed Work to provide occupant control for customizing environment.
4. Record floor plan Drawings indicating as-installed locations of uncontrolled and marked controlled receptacles superimposed on office furniture layout, to verify extent of ability of the installed Work to provide each occupant ability to select at least one uncontrolled receptacle and at least one controlled receptacle for powering workspace equipment. Indicate locations of UL-approved relocatable power taps and power strips, indicating means of securing protection from damage and accessibility for inspection. Indicate locations of temporary extension cords, indicating plan for replacing them with permanent wiring within 90 days.

E. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

B. Field Reports:

1. Manufacturer's field reports for field quality-control support.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 WARRANTY FOR DEVICES

A. Special Installer Extended Warranty: Installer warrants that installed devices perform in accordance with specified requirements and agrees to repair or replace products that fail to perform as specified within extended-warranty period. Warranty must convey to Owner upon acceptance of the Work.

1. Extended-Warranty Period: [**Two**][**Three**][**Four**]<**Insert number**> years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.

1. Initial Extended Warranty Period: [**Three**][**Four**][**Five**]<**Insert number**> years from date of Substantial Completion; [**full**][**prorated**] coverage for labor, materials, and equipment.
2. Follow-On Extended Warranty Period: [**Eight**]<**Insert number**> years from date of Substantial Completion; [**full**][**prorated**] coverage for materials only, free on board [**origin**][**destination**], freight prepaid.

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1.7 WARRANTY FOR CORD REELS

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed cord-reel power outlet assemblies perform in accordance with specified requirements and agrees to repair or replace assemblies that fail to perform as specified within extended warranty period.

1. Extended Warranty Period: [Two][Three][Four]<Insert number> years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that components of cord-reel power outlet assemblies perform in accordance with specified requirements and agrees to provide repair or replacement of components that fail to perform as specified within extended warranty period.

1. Initial Extended Warranty Period: [Three][Four][Five]<Insert number> years from date of Substantial Completion; [full][prorated] coverage for labor, materials, and equipment.
2. Follow-On Extended Warranty Period: [Eight]<Insert number> years from date of Substantial Completion; [full][prorated] coverage for materials only, free on board [origin][destination], freight prepaid.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Life Safety and Means of Egress Work: NFPA 101.
4. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
5. Wiring Devices: NECA NEIS 130.
6. Mounting Heights: NECA NEIS 1.

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7. Consult Architect for resolution of conflicting requirements.

C. Interfaces with Other Work:

1. Identification:

a. Identify cover or cover plate for device with panelboard identification and circuit number.
b. Mark cover or cover plate using hot, stamped, or engraved machine printing with [**black**][**white**][**red**]-filled lettering, and provide durable wire markers or tags inside device box or outlet box.
c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.
d. Healthcare Facilities: Distinctively identify covers or cover plates of device boxes and outlet boxes that are supplied from life safety and critical branch power supplies following facility's standard practice.

2. Coordinate installation of new products for <**Insert system or product group**> with existing conditions.

a. <**Insert requirements for transition between new and existing**>.

3. Coordinate with <**Insert Section number and title**> for <**Insert description of interfacing related Work**>.

a. <**Insert requirements for transition between this Section and related Work**>.

3.2 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
4. Work in ITE Rooms: NFPA 75.
5. Work in Health Care Facilities: NFPA 99 and Article 517 of NFPA 70.
6. Work in Confined Spaces: NFPA 350.
7. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
8. Installing and Maintaining Wiring Devices: NECA NEIS 130.
9. Mounting Heights: Unless otherwise indicated in the Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
10. Receptacle Orientation: Unless otherwise indicated in the Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.

a. Hospital-Grade Receptacle Orientation: Orient receptacle with ground pin

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or neutral pin at top.

11. Consult Architect for resolution of conflicting requirements.

C. Interfaces with Other Work:

1. Identification: Provide labels for receptacles and associated electrical equipment.

a. Identify field-installed conductors, interconnecting wiring, and components.
b. Label each enclosure with engraved metal or laminated-plastic nameplate.

1) Identify cover or cover plate for device with panelboard identification and circuit number.
2) Mark cover or cover plate using hot, stamped, or engraved machine printing with [**black**][**white**][**red**]-filled lettering, and provide durable wire markers or tags inside device box or outlet box.

c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.
d. Healthcare Facilities: Distinctively identify covers or cover plates of device boxes and outlet boxes that are supplied from life safety and critical branch power supplies following facility's standard practice.

2. Do not install Type 3 SPD, including surge-protected relocatable taps and power strips, on branch circuit downstream of GFCI device.
3. Coordinate installation of new products for <**Insert system or product group**> with existing conditions.

a. <**Insert requirements for transition between new and existing**>.

4. Coordinate with <**Insert Section number and title**> for <**Insert description of interfacing related Work**>.

a. <**Insert requirements for transition between this Section and related Work**>.

3.3 INSTALLATION OF CORD REELS AND FITTINGS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Maintenance: NFPA 70B.
3. Electrical Safety: NFPA 70E.
4. Hot Work: NFPA 51B.
5. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
6. Work in Confined Spaces: NFPA 350.

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7. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.

C. Special Techniques:

1. <Insert more stringent installation requirements that supplement or supersede manufacturers' instructions>.

D. Interfaces with Other Work:

1. Coordinate installation of new products for <Insert system or product group> with existing conditions.

a. <Insert requirements for transition between new and existing>.

2. Coordinate with <Insert Section number and title> for <Insert description of interfacing related Work>.

a. <Insert requirements for transition between this Section and related Work>.

3.4 FIELD QUALITY CONTROL OF SWITCHES

A. Administrant for Electrical Power Tests and Inspections:

1. [Owner][Tenant] will engage qualified medium-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified medium-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[with assistance of factory-authorized service representative].

B. Acceptance Testing Preparation:

1. <Insert requirements>.

C. Field tests and inspections must be witnessed by [Architect][Tenant][authorities having jurisdiction]<Insert names or titles of witnesses>.

D. Tests and Inspections:

1. Perform tests and inspections in accordance with manufacturers' published instructions.
2. <Insert tests and inspections>.

E. Nonconforming Work:

1. Unit will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

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F. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

G. Manufacturer Services: Engage factory-authorized service representative to [**support**][**supervise**] field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at the Project site.

3.5 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

A. Administrant for Electrical Power Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

B. Acceptance Testing Preparation:

1. <**Insert requirements**>.

C. Field tests and inspections must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

D. Tests and Inspections:

1. Insert and remove test plug to verify that device is securely mounted.
2. Verify polarity of hot and neutral pins.
3. Measure line voltage.
4. Measure percent voltage drop.
5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
6. Healthcare Facilities: Test straight-blade receptacles in patient care spaces with receptacle pin tension test instrument in accordance with NFPA 99. Retention force of ground pin must be not less than 115 g (4 oz).
7. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' published instructions.
8. <**Insert tests and inspections**>.

E. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

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F. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

G. Manufacturer Services: Engage factory-authorized service representative to [**support**][**supervise**] field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at the Project site.

3.6 FIELD QUALITY CONTROL OF CORD REELS AND FITTINGS

A. Administrant for Electrical Power Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

B. Acceptance Testing Preparation:

1. <**Insert requirements**>.

C. Field tests and inspections must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

D. Tests and Inspections:

1. Perform tests and inspections indicated in manufacturer's published instructions.
2. <**Insert Project-specific test or inspection**>.

E. Nonconforming Work:

1. Components and assemblies will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

F. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

G. Manufacturer Services: Engage factory-authorized service representative to [**support**][**supervise**] field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative,

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documenting activities performed at the Project site.

3.7 SYSTEM STARTUP FOR SWITCHES

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.
2. <**Insert startup steps if any**>.

B. Manufacturer Services: Engage factory-authorized service representative to [**support**][**supervise**] system startup.

1. Manufacturer's Field Reports for System Startup Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at the Project site.

END OF SECTION 262726

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Molded-case circuit breakers (MCCBs).
2. Enclosures.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
2. Enclosure types and details for types other than UL 50E, Type 1.
3. Current and voltage ratings.
4. Short-circuit current ratings (interrupting and withstand, as appropriate).
5. Include evidence of qualified electrical testing laboratory listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
7. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in [**PDF**][**and**]<**Insert calculation program format**> electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

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1. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.5 WARRANTY

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed enclosed switches and circuit breakers perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: [Two]<Insert number> years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that enclosed switches and circuit breakers perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: [Three]<Insert number> years from date of Substantial Completion; [full][prorated] coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain products from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Special Techniques:

1. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
3. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
4. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
5. Install fuses in fusible devices.

3.2 FIELD QUALITY CONTROL

A. [**Acceptance**]Testing Preparation:

1. <**Insert requirements**>.

B. Field tests and inspections must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

C. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest

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value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values may not exceed high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test in accordance with NETA ATS Section 7.14 "Ground Fault Protection Systems, Low-Voltage."

D. Tests and Inspections for Molded-Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that unit is clean.
e. Operate circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the following methods:

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1) Use low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with coordination study.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
c. Perform contact/pole resistance test. Drop values may not exceed high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
d. Perform insulation resistance tests on control wiring with respect to ground. Applied potential must be 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable. Test duration must be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values may be no less than 2 MΩ.
e. Determine the following by primary current injection:

1) Long-time pickup and delay. Pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
2) Short-time pickup and delay. Short-time pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

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3) Ground-fault pickup and time delay. Ground-fault pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
4) Instantaneous pickup. Instantaneous pickup values must be as specified and within manufacturer's published tolerances.

f. Test functionality of trip unit by means of primary current injection. Pickup values and trip characteristics must be as specified and within manufacturer's published tolerances.
g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of shunt trip and close coils must be as indicated by manufacturer.
h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset trip logs and indicators. Investigate units that do not function as designed.
i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Test and adjust controls, remote monitoring, and safeties.

E. Nonconforming Work:

1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

F. Collect, assemble, and submit test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

G. Manufacturer Services:

1. Engage factory-authorized service representative to [**support**][**supervise**] field tests and inspections.

3.3 MAINTENANCE

A. Infrared Scanning of Enclosed Switches and Breakers: Two months after Substantial Completion, perform infrared scan of joints and connections. Remove covers so joints and connections are accessible to portable scanner. Take visible light photographs at same locations and orientations as infrared scans for documentation to ensure follow-on scans match same conditions for valid comparison.

1. Instruments and Equipment: Use infrared scanning device designed to measure

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temperature or to detect significant deviations from normal values. Provide calibration record for device.

2. Follow-up Infrared Scanning: Perform two follow-up infrared scans of enclosed switches and breakers, one at four months and another at 11 months after Substantial Completion.
3. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.
4. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION 262816

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SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luminaire fittings.

B. Related Requirements:

1. Section 018116 "Facility Environmental Requirements" specifies basis-of-design environmental conditions and performance criteria that are applicable to product selection and installation of the Work on the Project.
2. Section 018123 "Facility Seismic and Wind Criteria" specifies basis-of-design seismic and wind criteria for nonstructural components on the Project.
3. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.
4. [**Section 260519 "Low-Voltage Electrical Power Conductors and Cables"**][**and**][**Section 260523 "Control-Voltage Electrical Power Cables"**] specifies wiring connections installed by this Section.
5. Section 260529 "Hangers and Supports for Electrical Systems" specifies channel and angle supports installed by this Section.
6. Section 260546 "Poles for Electrical Systems" specifies lighting standards, utility poles, and accessories referenced by this Section.
7. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
8. Section 260923 "Lighting Control Devices" specifies automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors installed by this Section.
9. Section 260936 "Modular Dimming Controls" specifies architectural dimming systems with dimming installed by this Section.
10. Section 260943.16 "Addressable Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" specify manual or programmable control systems with low-voltage control wiring or data communication circuits installed by this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Luminaires: Include the following additional information:

a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with

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specified listing criteria.

1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

b. Product Certificates: Include product certificates stating compliance with standards listed below, signed by manufacturer or fabricator.

1) Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with current accreditation under National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
2) Testing Agency Certified Data: For luminaires indicated on Lighting Fixture Schedule on the Drawings, photometric data certified by qualified independent testing laboratory. Photometric data for remaining luminaires must be certified by manufacturer.
3) Air and Thermal Performance Data: For air-handling luminaires, include data required in [**Section 233713.13 "Air Diffusers."**][**Section 233713.23 "Registers and Grilles."**][**Section 233713.43 "Security Registers and Grilles."**]
4) Sound Performance Data: For air-handling luminaires, indicate sound power level and sound transmission class in test reports certified in accordance with standards specified in [**Section 233713.13 "Air Diffusers."**][**Section 233713.23 "Registers and Grilles."**][**Section 233713.43 "Security Registers and Grilles."**]

c. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
d. Include operating characteristics, electrical characteristics, and furnished accessories.
e. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on the Drawings.
f. Include battery and charger data for emergency lighting units.
g. Include ballast factor.
h. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
i. Include photometric data and adjustment factors obtained from qualified laboratory tests.
j. Include manufacturer's sample warranty language.
k. <**Insert requirements**>.

2. Luminaire Fittings: Include the following additional information:

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a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
c. Include operating characteristics, electrical characteristics, and furnished accessories.
d. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on the Drawings.
e. Include manufacturer's sample warranty language.
f. <**Insert requirements**>.

B. Samples:

1. Luminaires: One for each kind of luminaire with specified rating, size, finish, color, and texture.
2. Luminaire Fittings: One for each kind of luminaire fitting with specified rating, size, finish, color, and texture.

C. Shop Drawings: Prepare and submit the following:

1. Drawings, Diagrams, and Supporting Documents for Custom Luminaires:

a. Include plans, elevations, sections, and mounting and attachment details.
b. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
c. Include diagrams for power, signal, and control wiring.

D. Sustainable Design Submittals:

1. Product data for sustainable design features for each type of product.
2. ASHRAE/IES 90.1 LPD Compliance Documentation: Prepare plans and calculations demonstrating that as-constructed lighting power density complies with mandatory provisions of ASHRAE/IES 90.1 and that as-constructed lighting, including daylighting and controls, improves on baseline energy performance. If included with Project, indicate locations of energy meters for lighting loads.

E. Field quality-control reports.

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1.3 INFORMATIONAL SUBMITTALS

A. Manufacturers' published instructions.

B. Field Reports:

1. Manufacturer's field reports for field quality-control support.
2. Manufacturer's field reports for system startup support.

1.4 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.5 MOCKUPS

A. Provide mockups as indicated on the Drawings to verify selections made under Sample submittals and to set quality standards for materials and execution.

1. Build mockup of luminaires in room or space, complete with power and control connections.
2. Obtain Architect's approval of mockups before starting installation of related Work on the Project.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
4. Maintain mockups during construction in undisturbed condition as standard for judging the completed Work.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY FOR LUMINAIRES

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed luminaires perform in accordance with specified requirements and agrees to repair or replace products that fail to perform as specified within extended-warranty period. Warranty must convey to Owner upon acceptance of the Work.

1. Extended-Warranty Period: [Two]<Insert number> years from date of Substantial Completion; full coverage for labor, materials, and equipment.

B. Special Manufacturer Extended Warranty: Manufacturer warrants that luminaires perform in accordance with specified requirements and agrees to provide repair or replacement of products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: [Five]<Insert number> years from date of Substantial Completion; [full][prorated] coverage for labor, materials, and equipment.

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1.7 WARRANTY FOR BATTERIES

A. Special Manufacturer Extended Warranty for Batteries: Manufacturer warrants that batteries perform in accordance with specified requirements and agrees to provide repair or replacement of batteries that fail to perform as specified within extended-warranty period.

1. Initial Extended-Warranty Period for Li-ion Batteries: [**Three**][**Four**][**Five**]<**Insert number**> years from date of Substantial Completion; full coverage for materials only, free on board [**origin**][**destination**], freight prepaid.
2. Follow-On Extended-Warranty Period for Li-ion Batteries: [**10**]<**Insert number**> years from date of Substantial Completion; prorated coverage for materials only, free on board [**origin**][**destination**], freight prepaid.
3. Initial Extended-Warranty Period for Ni-Cd Batteries: [**Five**]<**Insert number**> years from date of Substantial Completion; full coverage for materials only, free on board [**origin**][**destination**], freight prepaid.
4. Follow-On Extended-Warranty Period for Ni-Cd Batteries: [**15**]<**Insert number**> years from date of Substantial Completion; prorated coverage for materials only, free on board [**origin**][**destination**], freight prepaid.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
3. Work in Confined Spaces: NFPA 350.
4. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
5. Installation of Indoor Lighting Systems: NECA NEIS 500.
6. Installation of Exterior Lighting Systems: NECA NEIS 501.
7. Installation of Industrial Lighting Systems: NECA NEIS 502.
8. Installation of Luminaires, Lampholders, and Lamps: Article 410 of NFPA 70.

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9. Installation of Extra-Low-Voltage Lighting: Article 411 of NFPA 70.
10. Installation of Lighting for Sensitive Electronic Equipment: Article 647 of NFPA 70.
11. Installation of Emergency Lighting and Exit Signs: ICC IBC, NFPA 101, and Parts IV and V in Article 700 of NFPA 70.
12. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Install luminaires level, plumb, and square with finished floor or grade unless otherwise indicated.
2. Install luminaires at height and aiming angle as indicated on the Drawings.
3. Coordinate layout and installation of luminaires with other construction.
4. Adjust luminaires that require field adjustment or aiming.[**Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.**]
5. Exterior Bollard Luminaires:

    a. Align units for optimum directional alignment of light distribution.
    b. Install on concrete base with top [4 inch]<**Insert dimension**> above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

6. Exterior In-Ground Luminaires:

    a. Install on concrete base with top [4 inch]<**Insert dimension**> above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

7. Exterior Corrosion Prevention:

    a. Do not use aluminum in contact with earth or concrete. When in direct contact with dissimilar metals, protect aluminum with insulating fittings or treatment.
    b. When embedding steel conduits in concrete, wrap conduit with 10 mil thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

8. Flush-Mounted Luminaire Support:

    a. Secured to outlet box.
    b. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
    c. Trim ring flush with finished surface.

9. Wall-Mounted Luminaire Support: [**Attached to structural members in walls**][**Attached to a minimum 1/8 inch backing plate attached to wall structural members**][**Attached using through bolts and backing plates on either side of wall**]<**Insert means of attachment**>.

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a. Do not attach luminaires directly to gypsum board.

10. Suspended Luminaire Support:

    a. Ceiling Mount:

        1) Hook hangers.
        2) [**Two**]<**Insert number**> wires.
        3) [**Two**][**Four**]<**Insert number**> aircraft cables.

    b. Pendants and Rods: Where longer than **48 inch**, brace to limit swinging.
    c. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
    d. Continuous Rows of Luminaires: Provide tubing or stem for wiring at one point and [**tubing or rod**][**wire support**] for suspension for each unit length of luminaire chassis, including one at each end.
    e. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

11. Ceiling-Grid-Mounted Luminaire Support:

    a. Install ceiling support system rods or wires[**, independent of the ceiling suspension devices,**] for each luminaire. Locate not more than **6 inch** from luminaire corners.
    b. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for application.
    c. Luminaires of Sizes Smaller than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with no fewer than two **3/4 inch** metal channels spanning and secured to ceiling tees.
    d. Seismic Restraint: Install at least one independent support rod or wire from structure to tab on luminaire. Wire or rod must have breaking strength for luminaire weight with safety factor of 3.0.

12. Remote Mounting of Ballasts or Drivers: Do not exceed distance between ballast or driver and luminaire recommended by ballast or driver manufacturer.
13. Emergency Power Units: Secure with approved fasteners in four or more locations, spaced near corners of unit.
14. Install wiring connections for luminaires.
15. Identification: Provide labels for luminaires and associated electrical equipment.

    a. Identify field-installed conductors, interconnecting wiring, and components.
    b. Provide warning signs.
    c. Label each enclosure with engraved metal or laminated-plastic nameplate.

16. <**Insert more stringent installation requirements that supplement or supersede listed standards and manufacturers' published instructions**>.

D. Interfaces with Other Work:

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1. Coordinate installation of new products for <**Insert system or product family/category**> with existing conditions.

    a. <**Insert requirements for transition between new and existing**>.

2. Coordinate with <**Insert Section number and title**> for <**Insert description of interfacing related Work**>.

    a. <**Insert requirements for transition between this Section and related Work**>.

E. Systems Integration: Integrate lighting control devices and equipment with electrical power connections for operation of luminaires as specified.

3.2 FIELD QUALITY CONTROL OF LIGHTING

A. Administrant for Electrical Power Tests and Inspections:

1. [**Owner**][**Tenant**] will engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

B. Administrant for Field Tests and Inspections of Lighting Installations:

1. [**Owner**][**Tenant**] will engage qualified lighting testing and inspecting agency to administer and perform tests and inspections.
2. Engage qualified lighting testing and inspecting agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections[**with assistance of factory-authorized service representative**].

C. Acceptance Testing Preparation:

1. <**Insert requirements**>.

D. Field tests and inspections must be witnessed by [**Architect**][**Tenant**][**authorities having jurisdiction**]<**Insert names or titles of witnesses**>.

E. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Operational Test: After installing luminaires, switches, and accessories, and after

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electrical circuitry has been energized, test units to confirm proper operation.

3. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
4. Verify operation of photoelectric controls.
5. Exterior Illumination Tests:

    a. Measure light intensities at night. Use photometers with calibration referenced to NIST standards.

F. Nonconforming Work:

1. Luminaire will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

G. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

H. Manufacturer Services: Engage factory-authorized service representative to [**support**][**supervise**] field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at the Project's site.

3.3 SYSTEM STARTUP

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.
2. Burn-in lamps that require specific aging period to operate properly, prior to occupancy by Owner.
3. Charge [**emergency power units**][**and**][**batteries**] minimum of one hour and depress switch to conduct short-duration test.
4. Charge [**emergency power units**][**and**][**batteries**] minimum of 24 hours and conduct one-hour discharge test.
5. <**Insert startup steps if any**>.

B. Manufacturer Services: Engage factory-authorized service representative to [**support**][**supervise**] system startup.

1. Manufacturer's Field Reports for System Startup Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at the Project's site.

END OF SECTION 265000

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Envisage
ARCHITECTURE

6. EXTERIOR BUILDING SPECIFICATIONS

3244 Fairfield Ave ■ Cincinnati, OH 45207 ■ www.envisage-arch.com ■ 513.409.0609

SECTION 01 45 23 - TESTING

PART 1 - GENERAL

1.1 PULL / UPLIFT RESISTANCE TESTING:

A. Obtain independent third party firm to accomplish field pull testing [uplift resistance] of the existing OSB roof sheathing. Provide documentation to Owner and Architect for review.

B. Results of the pull tests may result in changes to the fastening rates in accordance with the manufacturer's requirements.

1.2 MOISTURE SURVEY

A. No moisture survey was conducted for this project.

1.3 ROOF MOUNTED EQUIPMENT

A. Anchor all existing roof-mounted equipment or provide new support stands to resist, uplift, sliding and overturning in accordance with building code requirements [includes equipment supports to the deck and equipment attachment to supports].

1.4 DRAINAGE TESTING

A. Prior to start of work, test each roof drain / scupper / downspout or other drainage component for proper water flow. Notify Architect / Owner of any clogged, leaking drainage and roof drains that cannot have the roof membrane secured to the existing clamping ring [broken, bolts, etc] or the drain bowl is cracked or bowl pipe connection is leaking/not watertight or piping below drain is leaking, blocked or otherwise not functioning [refer to the drawings]. The contractor shall identify any corrective actions and location of deficiencies. Commencement of work without notification shall constitute acceptance of drainage devices and any costs to unclog or repair these items shall be borne by the Contractor.

END OF SECTION

SECTION 04 01 00 - MAINTENANCE OF MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Repointing masonry, Parging, Water and/or chemical cleaning of masonry surfaces, water repellent.

1.2 SUBMITTALS

A. Product Data: Submit data on cleaning solutions, water repellent.

B. Manufacturer's Installation Instructions: Products selected for use, manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

A. Perform Work according to ACI 530 and ACI 530.1 requirements.

B. Installer: Company specializing in performing Work of this Section with three years' experience.

C. Coordinate work with masonry repairs, re-pointing, limited brick replacement, etc.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Repoint mortar joints and repair masonry only when air temperature is between and 40°f and 90°f and is predicted to remain so for at least 7 days after completion of work.
   1. In accordance with ACI 530.1

B. Hot-weather requirements: protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90°f and above.
   1. In accordance with ACI 530.1

C. Patch masonry only when air and surface temperatures are between and 55°f and 100°f and are predicted to remain above 55°f for at least 7 days after completion of work. On days when air temperature is predicted to go above 90°f, schedule patching work to coincide with time that surface being patched will be in shade or during cooler morning hours.

D. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure, work under demolition, or adjacent work to remain.

E. Prevent grout or mortar used in assembly and repair work from staining face of surrounding surfaces. Immediately remove grout and mortar in contact with exposed surfaces.

F. Protect sills, ledges, and projections from mortar droppings.

1.5 SEQUENCING

A. Perform repointing after cleaning masonry surfaces.

PART 2 PRODUCTS

2.1 MORTAR

A. Refer to Section 04 20 00.

2.2 MASONRY RESTORATION AND CLEANING

A. Cleaning Agent: Low Acid Cleaning Solution; Prosoco Sure Klean Light Duty Restoration Cleaner, Sure Klean Restoration Cleaner, or Equal.

2.3 WATER REPELLENT

A. Free flowing, colorless liquid, non water based.
   1. ProSoCo, 'Sure Klean', Weather Seal Siloxane PD'
   2. Diedrich Chemicals, 303S-7 Siloxseal'

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces to be cleaned are ready for Work of this Section.

3.2 PREPARATION

A. Close off and/or seal areas, landscaping, materials, and surfaces not receiving work of this Section to protect from damage.

3.3 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure. Do not use metal scrapers or brushes. Do not use acidic or alkaline cleaners.

B. Clean masonry debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

C. Sweep and rake adjacent pavement and grounds to remove masonry debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt, and stains.

3.4 GENERAL CLEANING

A. As work proceeds and on completion, remove excess mortar, smears, droppings.

B. Clean dirt and light staining from all brick surfaces.

C. If the specified chemicals and cleaning processes do not remove graffiti, paint, or other stains, contact Architect for direction.

D. Perform cleaning working from top to bottom working in sections around the building at one elevation at a time.

E. Use spray equipment that provides controlled application at volume and pressure indicated. Adjust pressure and volume to ensure cleaning methods do not damage masonry.

3.5 REPOINTING MASONRY

A. Joint raking: rake out all joints to be pointed by hand, using a mason's chisel that is not more than 1/4" thick or by approved hand grinding methods. If grinding is used, wet methods are required to minimize dirt and dust. Rake or grind out mortar from joints to depths equal to 2-1/2 times their widths but not less than 1-inch nor less than required to expose sound, un-weathered mortar.
   1. Remove mortar to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum or flush joints to remove dirt and loose debris. No abrasive methods of cleaning shall be used.
   2. Do not spall edges of masonry units or widen joints. Replace masonry units which become damaged.
      a. Do not use power-operated grinders without Architect's written approval based on submission by Contractor of a satisfactory quality-control program and demonstrated ability of operators to use tools without damaging masonry. Quality control program shall include provisions for supervising performance and preventing damage due to worker fatigue.
   3. Replace any units which become damaged.

4. if the existing bricks have worn rounded edges, recess final mortar slightly from face to a point where joint face will not be wider than the original joint.

B. Joint Pointing:
   1. Rinse masonry joint surfaces with water to remove any dust and mortar particles. Time application of rinsing so that, at time of pointing, excess water has evaporated or run off, and joint surfaces are damp but free of standing water.
   2. Apply first layer of pointing mortar to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8-inch until uniform depth is formed. Compact each layer thoroughly and allow to become thumbprint-hard before applying next layer.
   3. After joints are filled to uniform depth, place remaining pointing mortar in 3 layers with each of first and second layers filling approximately 2/5 of joint depth and third layer the remaining 1/5. Fully compact each layer and allow to become thumbprint-hard before applying next layer. Take care not to spread mortar over edges onto masonry surfaces, or to featheredge mortar.
   4. When mortar is thumbprint-hard, tool joints to match original appearance of joints as determined by the architect. Remove excess mortar from edge of joint by brushing.
   5. Cure mortar by maintaining in damp condition for not less than 72 hours.

3.6 PARGING

A. Parge concrete/CMU foundation walls as follows:
   1. Provide all required tuckpointing of mortar joints prior to parging.
   2. Dampen masonry walls prior to parging.
   3. Surface Preparation
      a. Surface preparation is extremely important for proper adhesion. Substrates must be sound, and free of dust, dirt, laitance, paints, oils, grease, curing compounds, or any other contaminants. Verify substrate has properly cured. Concrete should obtain 80% of design strength, typically achieved within 3 to 14 days. If efflorescence is present, mechanically remove it before proceeding.
      b. All holes and cracks must be patched before installation.
      c. Extremely smooth surfaces such as precast and cast-in-place concrete will require roughening or brush blast to ensure good adhesion.
   4. Mixing
      a. Thoroseal is to be mixed with a mixing liquid consisting of a blend of Acryl 60 diluted with water. Dilute and mix per manufacturer requirements.
      b. Refer to manufacturer requirements for blending, consistency, and for pot life.
   5. Application
      a. Thoroseal may be applied with a brush or broom or equivalent stiff fiber brush. Spray application not permitted. The substrate must be completely dampened with water before application starts. Do not saturate the substrate, but keep it cool and damp throughout the application.
      b. It is essential that the first coat be thoroughly worked into the substrate to completely fill and cover all voids, holes, and nonmoving cracks. Finish with a horizontal stroke for an even coat.
      c. Allow to cure 24 hours, then apply the second coat and finish with a vertical stroke. Above grade, the second coat can be replaced with a Thoro high-build architectural coating to achieve better color uniformity.
      d. On block or masonry walls, allow 5-7 days before applying second coat to eliminate joint read through.

3.7 FINAL CLEANING

A. Where re-pointing work precedes cleaning of masonry, allow mortar to harden at least 30 days prior to final cleaning.

B. After mortar has fully hardened, thoroughly clean exposed masonry surfaces using stiff nylon or fiber brush and clean water, spray applied at low pressure.

3.8 SURFACE CLEANING APPLICATION

General: Cleaners shall be installed in accordance with the recommendation of the manufacturer.

A. All masonry surfaced shall be cleaned utilizing a pressure water spray (1,000 p.s.i. max.).
   1. Intent of cleaning program is to remove all surface staining, smoke, dirt, and fungal growth.

3.9 WATER REPELLANT APPLICATION

General: Water repellant shall be installed in accordance with the recommendation of the manufacturer.

A. All masonry surfaced shall have the water repellant installed utilizing a low-pressure water spray (50 psi max.), brush or roller at the rate recommended by the manufacture. Flow coat to saturation point, allow for penetration 5 -10 minutes.

3.10 SCHEDULES

A. General: verify all existing masonry conditions, including anchorage to substrate, to determine scope of masonry repairs. Refer to drawings and additional work allowances to be included in the bid.

B. Limestone Sills: Remove and reset all limestone sills that are loose, displaced, or disbonded. If stone is cracked, broken, or missing, install a new limestone sill to match existing.
   1. Replacement will be a field change if needed.

C. Masonry Repairs:
   1. Remove damaged, cracked, spalled, or dislocated masonry units as required by conditions.
   2. Replace damaged masonry with new or salvaged masonry as applicable to the repair. Install new masonry per Section 04 20 00. Tooth into existing masonry as appropriate.

D. Masonry Tuckpointing:
   1. Tuck point existing mortar joints where indicated and as required by existing conditions.
   2. Tuck point locations of removed hose bibs, address plaques, building equipment, electrical service, conduits, wiring, etc. that were anchored into the mortar joints.

END OF SECTION

SECTION 04 20 00 - UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes concrete masonry units, clay face brick, stone caps, reinforcement, anchorage, mortar and grout, and accessories.

1.2 SUBMITTALS

A. Product Data: For each type of CMU component, clay face brick, stone caps, mortar / mix design, grout, reinforcement, and accessories.

B. Samples: face brick, in the form of straps of five or more bricks to show full color range.

1.3 PERFORMANCE REQUIREMENTS

A. Concrete Masonry Compressive Strength (f'm): 2,000 psi; determined by unit strength method.

B. Clay masonry Compressive Strength (f'm): 3,000 psi; determined by unit strength method.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Assume responsibility for acceptance of masonry units delivered to Project site being in compliance with specified ASTM requirements for chippage and dimensional tolerances.
   1. Inspect decorative units upon delivery to ensure color match with required materials and accepted mock-up panel.

B. Store masonry units on elevated platforms in a dry location to prevent contamination by mud, dust or materials likely to cause staining or other defects. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
   1. Cover masonry units at all times.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
   1. Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands.
   2. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store sand on tarps to keep ground water from wicking into sand.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Temporary measures include application of self-adhered membrane or flashing with long UV exposure. Cover partially completed masonry when construction is not in progress. Continue to cover walls until tie-in to roof is complete and top of wall is protected from water penetration.

B. This structure is designed to be self-supporting and stable after the building is fully completed. Protect masonry walls against wind damage by bracing as required until support of walls is integral with the completed building structure. This includes the addition of whatever temporary bracing, guys, or tie-downs that might be necessary. Safety: It is solely the Contractor's responsibility to follow all applicable safety codes and regulations governing this Work.

C. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure, work under demolition, or adjacent work to remain.

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect sills, ledges, projections, and adjacent building materials / finishes from mortar droppings.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

B. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

C. Patch masonry only when air and surface temperatures are between and 55°f and 100°f and are predicted to remain above 55°f for at least 7 days after completion of work. On days when air temperature is predicted to go above 90°f, schedule patching work to coincide with time that surface being patched will be in shade or during cooler morning hours.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Concrete Masonry Units: ASTM C 90.
   1. Size and Shape: Nominal modular sizes as indicated on Drawings.
      a. Furnish special units for 90 degree corners, bond beams, lintels, jambs, bullnosed corners.
   2. Weight Classification: Normal Weight.
   3. Exposed Faces: Refer to Drawings – smooth face.

B. Face Brick: ASTM C 216, Type FBS, Grade MW, color and texture to match existing brick,
   1. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
   2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   3. Size: Modular, 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

C. Precast Concrete sills: fabricated to suit opening, sized as required. Positive slope out to face of wall, extend 1 inch past face of brick.

2.2 MASONRY LINTELS

A. Prefabricated or built-in-place masonry lintels made from specially formed "U" shaped lintel units with reinforcing bars placed as indicated and filled with coarse grout. Open bottom, bond-beam type units are not acceptable for use as reinforced lintels. Cure prefabricated lintels before handling and installing. Temporarily support built-in-place lintels until cured.
   1. Prefabricated lintels shall have a faux head joint pattern on their exposed faces and shall have their top side clearly marked in the factory. Prefabricated lintels are to be installed such that the faux head joint pattern aligns with that of the surrounding masonry.

2. Knockout blocks are not acceptable.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color(s) indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: ASTM C 150, Packaged blend of Portland cement, Type I or Type III, and ASTM C 270 hydrated lime, Type S.

D. Mortar Cement: ASTM C 1329.

E. Mortar Pigments: ASTM C 979, Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes.

F. Colored Cement: Packaged blend made from Portland Cement and lime, masonry cement, or mortar cement and mortar pigments, all complying with specified requirements.

G. Aggregate for Mortar: ASTM C 144.

H. Aggregate for Grout: ASTM C 404.
   1. Fine Aggregates: ASTM C 404, clean, sharp, natural sand free from loam, clay lumps, or other substances.
   2. Coarse Aggregates: ASTM C 404, clean uncoated, pea gravel containing no clay, mud, load, or foreign matter. Maximum aggregate size 3/4 inch.

I. Water: ATSM C 1602.

2.4 MORTAR AND GROUT MIXES

General: Match original mortar remnants on brick as determined from field sampling and laboratory analysis at the mortar manufacturers plant. Match for color, texture and compressive strength.

A. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade use Type M, where indicated only.
   2. For masonry, use Type S, unless otherwise noted.
   3. For non-load bearing interior partitions, use Type N or S, unless otherwise noted.
   4. For exterior, above-grade, masonry veneer, use Type N or S, unless otherwise noted.

B. Natural [uncolored] Mortar: locations where masonry will be painted.

C. Colored Pigmented Mortar: locations of decorative masonry [non-painted]

D. Grout for Unit Masonry: ASTM C 476.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60, deformed steel bars.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells.

C. Masonry Joint Reinforcement: ASTM A 951, galvanized welded wire mesh.
   1. W1.7 x W1.7 wire mesh unless noted otherwise on Drawings, located at 16 inches on center vertically

2.6 TIES AND ANCHORS

A. Helical Ties: Simpson Heli-Tie Wall Ties or Equal, size and spacing per drawings.

B. Single Wythe Joint Reinforcement: ASTM A951/A951M; truss or ladder type; steel; 0.148 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.

C. Wall Ties: Corrugated formed sheet metal, 1” x 7” inch size x 20 gage thick; ASTM A153/A153M hot dip galvanized. Provide fasteners suitable for fastening through insulation board into framing [if applicable].

D. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

E. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

F. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.

H. Intersecting Masonry Wall Joint Reinforcing: Where interior masonry walls supported on slabs intersect masonry walls, provide hot dip galvanized 1/2 inch by 16 gauge mesh ties spanning horizontally.

2.7 FLASHING

A. Non-vapor permeable, Self-adhered SBS rubberized asphalt compound laminated to a polyethylene film, specifically designed for thru-wall flashing.
   1. Thickness: 40 mils
   2. Water Vapor Permeance, ASTM E 96: 0.03 perms

2.8 ACCESSORIES

A. Compressible Filler: ASTM D 1056, Premolded filler strips, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

B. Preformed Control-Joint Gaskets: ASTM D 2000, styrene-butadiene-rubber compound, or ASTM D 2287, PVC and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Cellular Plastic Weep / Vent: One-piece, flexible extrusion, UV resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of other wythe.

E. Cavity Mortar Protection Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

F. Elastomeric Tubing Sealant Backings: ASTM D 1056, Grade 2A1, Neoprene, butyl, EPDM, or silicone tubing, non-absorbent to water and gas. Size and shape for conditions.

G. Masonry Cleaners: Manufacturer's standard strength, general purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned. Do not use products containing hydrochloric (muriatic acid, hydrofluoric acid, or ammonium bifluoride).

H. Water Repellent: Apply manufacturer recommended water repellent / sealer to cast stone.

I. Anchors: Non-corrosive type, sized for conditions, hot dip galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Coordinate placement of anchors supplied by other sections.

B. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Coursing of Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Coursing of Brick units:
   1. Bond: Running
   2. Coursing: Three units and three mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

E. Cut mortar joints flush where ceramic wall tile or other wall covering is scheduled, cement parging is required, resilient base is scheduled.

F. Joint Reinforcement And Anchorage - Single Wythe Masonry:
   1. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first joint below top of walls.
   2. Place masonry joint reinforcement in first horizontal joint above and below openings. Extend minimum 16 inches each side of opening.
   3. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches oc.

G. Joint Reinforcement And Anchorage - Masonry Veneer:
   1. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first and second joint below top of walls.
   2. Place masonry joint reinforcement in first horizontal joint above and below openings.
   3. Secure wall ties to stud framed backing and embed into masonry veneer at maximum 16 inches oc vertically and 16 inches oc horizontally.
   4. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb of wall openings.
   5. Place wall ties at maximum 8 inches on center horizontally within 8 inches of head and sill of wall openings.

H. Lintels:
   1. Install loose steel, bond beams or precast concrete lintels over openings.

2. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
3. Maintain minimum 8 inch bearing on each side of opening.

I. Grouted Components:
1. Reinforce bond beam and pilasters as detailed.
2. Support and secure reinforcing bars from displacement.
3. Place and consolidate grout fill without displacing reinforcing.
4. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.

J. Masonry Protection: Protect completed masonry and masonry not currently being worked on.

K. Control Joints:
1. Install control joints at the following maximum spacings, unless otherwise indicated on Drawings:
   a. Exterior Walls: 20 feet on center and within 24 inches on one side of each interior and exterior corner.
   b. Interior Walls: 30 feet on center.
   c. At changes in wall height.
2. Do not continue horizontal joint reinforcement through control joints.
3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
4. Install preformed control joint device in continuous lengths. Seal butt and corner joints.

L. Built-In Work:
1. As work progresses, install built-in metal door frames, window frames, anchor bolts and plates and other items to be built in the work furnished by other sections.
2. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings].

M. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
1. Install adjustable hollow metal frame anchors, locating anchors on jambs in horizontal bed courses near the top and bottom of each frame and at intermediate points not over 24 inches apart.
2. Unless otherwise noted or thermal break is required, contractor may grout jambs of hollow metal door and window frames in accordance with ANSI 250.8. Where grout is installed during masonry installation, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand troweled into place. Grout mixed to a thin “pumpable” consistency shall not be used.
3. Rake joints around exterior side of exterior hollow metal door frames for sealant.
4. Protect inside (concealed) faces of door frames in exterior masonry walls, using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8 inch thick and allow to dry before handling.
5. Where hollow metal frames do not wrap around masonry jambs and heads, rub exposed corners of block to remove sharp, irregular edges.
6. Take particular care to embed all conduits and pipes with concrete masonry without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Where electric conduits, outlets, switch boxes, and similar items occur, grind and cut units before building in services. Prepare cutouts in such a manner that units can be installed plumb and flush.

7. Install anchors, reglets, and nailers for flashing and related work built into masonry work, where indicated.

N. Where built-in items are to be embedded in cores of hollow masonry units, place a grout stop (a layer of metal lath, wire mesh, or plastic mesh) in the joint below and rod mortar or grout into core.

O. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

P. Control Joint Locations in CMU: Provide vertical control joints in reinforced CMU where noted on Drawings and in accordance with the National Concrete Masonry Association, specifically at all offsets, returns, openings, and intersections with dissimilar materials and as follows to prevent cracking:

Q. Flashing: Install embedded flashing and weep vents in first course of masonry above ground level, at lintels, ledges, above doors, windows and other openings and under coping and sills, other obstructions to downward flow of water in wall. Flashing shall be installed longitudinally continuous or terminated with end dams. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities. Comply with NCMA recommendations for “drainage wall system” masonry construction.
   1. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels and turn down on outside face to form drip.
   2. Turn flashing up minimum 8 inches and seal to sheathing over wood framed back-up.
   3. Lap end joints and seal watertight.
   4. Turn flashing, fold, and seal at corners, bends, and interruptions.

R. Weeps: Install weeps in outer wythe at 24 inches oc horizontally above through-wall flashing, at bottom of walls, and other locations where the downward flow of water will be stopped.

S. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes.

T. Cleaning:
   1. Remove excess mortar and mortar smears as work progresses.
   2. Clean soiled surfaces with cleaning solution.

U. Tolerances:
   1. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
   2. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes structural wall and roof framing, built-up structural members, wall and roof sheathing; subfloor sheathing; flashings; preservative and fire retardant treatment; blocking and related furring and framing materials.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. American Wood-Preservers' Association:
   1. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.
   2. AWPA U1 - Use Category System: User Specification for Treated Wood.

C. ASTM International:
   1. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   4. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

D. Forest Stewardship Council:
   1. FSC Guidelines - Forest Stewardship Council Guidelines.

E. Green Seal:
   1. GS-36 - Aerosol Adhesives.

F. National Lumber Grades Authority:
   1. NLGA - Standard Grading Rules for Canadian Lumber.

G. Northeastern Lumber Manufacturers Association:
   1. NELMA - Standard Grading Rules for Northeastern Lumber.

H. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

I. Southern Pine Inspection Bureau:
   1. SPIB - Standard Grading Rules for Southern Pine Lumber.

J. U.S. Department of Commerce National Institute of Standards and Technology:
   1. DOC PS 1 - Construction and Industrial Plywood.
   2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
   3. DOC PS 20 - American Softwood Lumber Standard.

K. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

L. Western Wood Products Association:
   1. WWPA G-5 - Western Lumber Grading Rules.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:
   1. Lumber Grading Agency: Certified by DOC PS 20.

2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.
3. Plywood Grading Agency: Certified by APA.
4. Lumber: DOC PS 20.
5. Wood Structural Panels: DOC PS 1 or DOC PS 2.

B. Perform Work in accordance with Ohio Building Code.

C. Apply label from agency approved by authority having jurisdiction to identify each preservative treated and fire retardant treated material.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

A. Lumber Grading Rules: SPIB, ASLS.

B. Beam Framing: southern yellow pine species, No. 1 grade, 2” and wider size classification, 19 percent maximum moisture content.

C. Joist Framing: southern yellow pine species, No. 1 grade, 2” and wider size classification, 19 percent maximum moisture content.

D. Columns: southern yellow pine species, No. 2 grade, 4” and wider size classification, 19 percent maximum moisture content.

E. Non-structural Light Framing: Stress Group D, spruce, pine, fir species, 19 percent maximum moisture content.

F. Studding: Stress Group D, spruce, pine, fir species, 19 percent maximum moisture content.

G. Sill Plate: AWPA C2 Lumber, Stress Group D, spruce, pine, and fir species, and 19 percent maximum moisture content, pressure preservative treated.

2.2 SHEATHING MATERIALS

A. Wall Sheathing: ANSI A208.1, Oriented Strand Board [OSB]; wood chips set with waterproof resin binder; unsanded faces; 1/2 inch thickness; 48x96 inch sized sheets [match existing conditions]

B. Roof Sheathing: ANSI A208.1, Oriented Strand Board [OSB]; wood chips set with waterproof resin binder; unsanded faces; 1/2 inch thickness; 48x96 inch sized sheets [match existing conditions]

C. Subfloor Sheathing: APA Rated Sheathing Structural I, Span Rating 24/16, Exposure Durability 1, unsanded; 3/4 inch thickness; 48x96 inch sized sheets [match existing conditions]

2.3 UNDERLAYMENT

A. Not Applicable.

2.4 FIREBLOCKING AND FIRESTOPPING

A. Fireblocking: Solid lumber, structural wood panel, or particleboard.
1. Solid lumber nominal 2 inches thick.
2. Structural wood panel 23/32 inch thick with joints backed by structural wood panel.

B. Draftstopping: Gypsum board or OSB
1. Gypsum board: 1/2 inch thick.
2. OSB: 7/16 inch thick.

2.5 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Nails and staples: ASTM F1667.

B. Die Stamped Connectors: galvanized steel, specific type/profile as applicable

C. Structural Framing Connectors: Galvanized steel, sized to suit framing conditions.
   1. Simpson or Equal.

D. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Powder actuated fasteners into slab. Hilti or Equal. All anchors sized to suit application and loads.

E. Sill Gasket: Plate width, closed cell foam strip.

F. Sill Flashing: Polyethylene Sheet or Galvanized Steel.

G. Subfloor Glue: ASTM D3498, water base, waterproof.

H. Weather Resistive Barrier / Building Paper: ASTM D226; spun bonded polyethylene, Tyvek or Equal. Coordinate with existing conditions as appropriate.

I. Self Sealing, Flexible Flashing: 40 mil thick, self-adhesive, cold applied flashing. GCP Applied Technologies, Vycor Flashing or Equal.

2.6 WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA U1, Commodity Specification A-Sawn Products or F-Wood Composites using water-borne preservative with .25 pcf retention.

B. Fire Retardant Treatment: Chemically treated and pressure impregnated, having flame spread of 25 or less when tested in accordance with ASTM E 84 and showing no evidence of significant progressive combustion when test is continued for an additional 20 minute period, Exterior or Interior Type.

C. Moisture Content After Treatment: Kiln dried (KDAT).
   1. Lumber: Maximum 19 percent.
   2. Structural Panels: Maximum 15 percent.

PART 3 EXECUTION

3.1 FRAMING

A. Set structural members level and plumb, in correct position.

B. Fasten framing in accordance with Ohio Building Code.

C. Place horizontal members crown side up.

D. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

E. Provide all required shoring and temporary bracing required to support structure prior to removing any load-bearing components.

F. Construct load bearing framing members full length without splices.

G. Double members at openings. Space short studs over and under opening to stud spacing.

H. Place full width continuous sill flashings under framed walls on cementitious foundations. Lap flashing joint 4 inches.

I. Place sill gasket directly on cementitious foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

J. All exterior framing intended to be left exposed to weather shall be pressure treated and anchored with galvanized fasteners and appropriate connectors.

K. All framing in contact with concrete shall be treated. Interior or exterior walls.

L. Frame new walls, partitions, and openings to suit conditions and as designed.

M. Install solid 2x bearing at each end of beams and headers. Ensure that blocking is positioned with full support/blocking under to existing bearing conditions. Install supplemental blocking as required between joists, framing, etc.

N. Bridge joists at mid-space with solid 2x blocking.

3.2 SHEATHING

A. Install sheathing over framing members in full size sheets in accordance with APA Construction Guide.

B. Fasten sheathing in accordance with Ohio Building Code.

C. Install subfloor sheathing with longer edge perpendicular to floor framing with end joints staggered. Secure sheet edges over firm bearing. Attach sheathing with subfloor glue and appropriate fasteners.

D. Install underlayment in accordance with APA Construction Guide.

E. Secure wall sheathing with ends staggered, over firm bearing.

F. Install new underlayment at areas of wood framed floor systems where required for new finish flooring. Remove all existing underlayment down to original subfloor as required.

G. Place WRB/building paper over wall sheathing, weather lap joints and end laps, staple in place. Coordinate flashing installation to ensure continuous water resistant barrier.

3.3 FIREBLOCKING AND DRAFTSTOPPING

A. Install fireblocking to cut off concealed draft openings as required.
   1. Concealed Framed Wall and Furred Spaces: Install fireblocking vertically at floor and ceiling levels and horizontally.
   2. Connections Between Horizontal and Vertical Spaces: Install fireblocking between vertical walls and partitions and the following:
      a. Horizontal floor and roof framing.
      b. Soffits, dropped ceilings, cove ceilings and other horizontal concealed spaces.

3.4 SITE APPLIED WOOD TREATMENT

A. Treat site sawn cuts. Brush apply one coat of preservative treatment on untreated wood in contact with cementitious materials.

B. Allow preservative to cure prior to erecting members.

3.5 TOLERANCES

A. Framing members: ¼ inch from indicated position, maximum.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY FOR ROOFING

PART 1 - GENERAL

1.1 WORK INCLUDES, BUT NOT LIMITED TO:

A. Miscellaneous sized new wood nailers/blocking, curbs, fascia/trim boards, roof framing members, plywood and associated fasteners, bolts and adhesives as required for installation of the roofing system and sheet metal.

B. Secured existing or new wood members that meet the requirements of Section 07 01 50 can remain in place as per conditions/guidelines and attachment as specified herein. All existing sound decking to be refastened as outlined herein. Review the existing fastening on all remaining wood nailers/blocking and upgrade if necessary to meet the attachment requirements as outlined herein. Any new replacement nailers must be minimum of 1-1/2 inch x 5-1/2 inch [nominal 2x6] unless otherwise noted or conditions dictate otherwise. New nailers shall be elevated/ blocked up to match thickness of new insulation, as applicable.

1.2 APPLICABLE REFERENCES

A. The following references form a part of this specification.
1. NFPA - National Forest Products design specifications.
2. Factory Mutual Research Corporation, Loss Prevention Data Sheet 1-49, Perimeter Flashings.
3. APA - American Plywood Association.
4. Lumber Grading Agency.
5. American Wood Preservers Association
6. State Building Code
7. ANSI/SPRI/FM 4435 ES-1 Edge Systems.
8. WWPA - Western Wood Products Association
9. SPIB - Southern Pine Inspection Bureau
10. ASTM C476 Standard Specification for Grout for Masonry.
11. AWPA - American Wood Protection Association

B. Perform work in accordance with Local Building Code.

PART 2 - PRODUCTS

2.1 DIMENSIONAL LUMBER

A. Board Stock: Graded in accordance with NFPA and Lumber Grading Agency, board class number 2, structural grade, kiln-dried Douglas fir or Southern yellow pine. Moisture content for all lumber shall not exceed 19% by weight at time of installation, including any lumber that can remain in place. Lumber will be removed if moisture content exceeds 19%. Provide fire retardant treated blocking in combustible buildings according to ASTM E84. Sizes as shown are standard nominal sizes. Provide dressed lumber, S4S, unless otherwise noted.
1. Any lumber intended to be left exposed shall be appearance grade, suitable for a painted finish or finish as specified.
2. Where fire retardant treated lumber/materials are indicated, use product with flame spread index of 25 or less in accordance with ASTM E 84.

B. Preservative treated: AWPA, asphaltic, creosote or copper additive [CA & ACQ] type treated lumber is not acceptable for use on this project. Use MQC or CCA [wolmanized] water borne treated lumber complying with C2 and C5 standards for use as nailers on top of concrete or masonry wall surface and other above grade applications. Use treatment that does not promote corrosion of metal fasteners.

C. Plywood decking: Refer to Section 06 10 00.

2.2 FASTENERS

A. General: Contractor to determine the required length for each application in accordance with manufacturer data and Factory Mutual Data Sheet 1-49 recommendations.
   1. Minimum embedment:
      a. Steel-3/4 inch unless otherwise noted.
      b. Wood-1 1/4 inch unless otherwise noted.
      c. Concrete/concrete block [masonry] -1 1/4 inch unless otherwise noted.
   2. Comply with the fastening requirements of the Local Building Code and State requirements, whichever is more stringent.
   3. All fasteners to anchor wood members shall be corrosion-resistant steel unless exposed to weather, pressure preservatives or in high humidity areas, provide fasteners of Type 304 Stainless steel, compatible for the conditions or other requirements stated herein [as noted].
   4. Refer to roofing section for additional fastener data.
   5. Notify Owner if deteriorated substrate conditions exist.

B. Lag Bolts: ANSI/ASME B18.2.1

C. Steel Bolts: ASTM A 307, Grade A

D. Decking Nails: ASTM F 1667 [RSRS-01], 10d, 9 gauge, 0.121-inch diameter [or larger if required by code], ring-shank, corrosion resistant by coating [ASTM A 641 Class 1], flat head.

E. Wood Screws: ANSI/ASME B 18.6.1-81 [2016] or ASTM A 153, corrosion resistance by coating, galvanization or stainless steel.

F. Expansion Anchors: Steel, corrosion resistant, 3/8-inch diameter.

2.3 ADHESIVES

A. Standard wood adhesive, caulk grade.

B. ITW Red Head, A7 acrylic adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect fastening of existing wood members left in place for conformance to requirements specified herein, upgrade as necessary to meet performance criteria outlined.

B. Examine surfaces for satisfactory conditions and do not use materials that are warped, bowed, twisted or unsound.

3.2 INSTALLATION

General: Installation shall be in accordance with Factory Mutual Loss Prevention Data Sheet 1-49 perimeter flashing recommendations and details, Local Building Code, ANSI/SPRI/FM 4435 ES-1, other standard industry framing methods and as shown.

A. Attachment withdrawal resistance criteria for nailers/wood blocking is 250 P/F for perimeter, 300 P/F for corners onto substrate with margins of safety applied from printed values, as follows: Steel, Wood, Structural Steel 2:1, Concrete, 4:1, Gypsum 3:1. No power actuated fasteners or pin drive fasteners allowed. Fastener spacing as outlined below is the maximum allowable, unless otherwise shown on the plans, exception: maximum spacing shall be 18 inches on center in the perimeter and 12 inches on center in the corners [see below].

B. Install members true, plumb and level, secure in place. Provide all required shoring and temporary bracing required.
   1. Use members of continuous possible lengths. Do not use materials with defects or pieces that are too small [optimum joint arrangement].

2. # 8 screws or 10d nails used to secure fascia and top nailers [stacked] to other wood members shall penetrate 1-1/2 inch, apply stacked nailers in two rows at 24 inches on center at perimeters and 12 inches in corners, staggered if feasible.
3. Wood nailers/blocking shall have a ¼ inch space between boards.

C. Metal/Metal and Wood Decks: Wood nailers on deck at perimeter/corners shall be fastened to the deck with two rows of #14 steel, wood to metal deck [Tek] fasteners [wafer head] or #14 HD steel roofing fastener or appropriate #14 wood screw at **24*** inches on center staggered in perimeters and **12*** inches staggered in corners. Start fasteners 3 inches from each end of the board, staggered fasteners 2 inches from edge if nailer is wider than 5 1/2 inches [if existing or stacked wood nailers exceed 6 inches in thickness height consult RDA for fastener selection]. An alternative method, when nailers/blocking are parallel to deck ribs, the nailers can be attached to the structural members [joists] with 3/8-inch steel bolts/nuts or Tek/5 self-tapping fasteners, 7 feet on center max. spacing. All fasteners must penetrate the top flange of the deck and be driven flush or countersunk, if necessary.

D. Steel Members: Wood nailers at perimeter/corners shall be fastened to a steel member with one row of #14 or 1/4-inch steel, wood to metal deck [Tek/5 self-tapping fasteners] at 18 inches on center, centered, stagger fasteners 2 inches from edge if nailer is wider than 6 inches; pre-drill holes and countersink, if necessary. Fasteners shall start 3 inches from each end of the boards and shall be spaced **16*** inches on center each way from the corner.

E. Concrete Block/Concrete, Stone and Concrete Decking: Wood nailers at perimeter/corners or on top of parapet wall shall be fastened with one row [two rows if nailer is over 5 1/2 inches wide] of 1/4-inch self-tapping fasteners at **24*** inches on center [offset or staggered] in perimeters and **16*** inches [offset or staggered] in corners-each way. Fasteners shall be spaced 2 inches from edge if nailer is wider than 5 1/2 inches; pre-drill holes and countersink, if necessary. Fasteners shall start 3 inches from each end of the boards [if existing or stacked wood nailers exceed 6 inches in height consult Architect for fastener selection] or use a 3/8-inch diameter treaded rod placed into a pre-drilled hole with adhesive injected for a solid substrate, bolt boards to rod. Rods placed at 3 feet on center in the perimeter and 2 feet on center in corners-each way. Cores of hollow block must be completely filled with grout [forming a bond beam] where rods are located. Embed rods 5 inches minimum into filled block cores or solid block/concrete.

F. Plywood Sheathing. Install replacement sheathing in full sheet onto existing rafters/joists/trusses. End joints should be directly over center of rafters/joists/trusses and be attached with 10d ring shank nails spaced *6* inches on center at the perimeter and 12 inches on center at field of each panel at each rafter/joist/truss [nail penetration into rafters/joists/trusses,2 inches]. All existing sound decking shall be refastened to ensure a fastener is spaced no further than 6 / 12 inches. Joints in the next board should not occur in the same structural member space. No decking boards shall be used that are not long enough to span over two structural members, if applicable. Steep Sloped Application: Allow a two-inch space on each side at the ridges for proper ventilation to occur from the ridge vents, if ridge vents are required. In addition, provide u-shaped expansion clips between sheets that are not nailed in place.

3.3 SURFACE TREATMENT

A. All exposed to view newly installed wood members shall be primed and painted to match surrounding adjacent surfaces colors, unless otherwise noted.

END OF SECTION

SECTION 07 01 50 – PREPARATION FOR REROOFING

PART 1 – GENERAL

1.1 WORK INCLUDES, BUT IS NOT LIMITED TO:

General: Roof Membrane Removals and Other Removal Summary [Refer to section 01 45 23 for deck testing requirements]: Roof Replacement at Buildings 1503 and 1515 Linn Street only.

Roofs A-1, A-2, C-1 and C-2: Remove the entire roof system down to the structural wood deck. Removal includes EPDM membrane, insulation, fasteners, flashings, and other rooftop components, see other removals below.

Roofs B-1, B-2, B-3, B-4, B-5, B-6, B-7, B-8, B-9, and B-10: Remove the entire roof system down to the structural wood deck. Removal includes EPDM membrane, tapered insulation, fasteners, flashings, and other rooftop components, see other removals below.

A. Removal of existing perimeter base flashing [metal, EPDM / single ply as applicable] and associated equipment supports and related items.
   1. Removal and reinstall existing electrical conduits, cable lines and associated wall attachments.

B. Removal of wood nailers and blocking. Wood members that are securely bolted or adequately fastened or can be adequately fastened to the structure per the specifications and are in a dry good condition can remain in place as a base for new members or sheet metal items. Remove deteriorated and damaged wood members. [Refer to section 06 10 53 for anchoring requirements].

C. Removal of sheet metal items such as copings, edges, scuppers, conductor heads, downspouts, skirt flashings, counter-flashings, penetration pockets, pipe flashings, equipment supports and like components necessary for application of new membrane.

D. Removal of existing unused curbs, membrane repairs, abandoned equipment as noted in the drawings.

E. Removal of existing curbs, vents and covering of associated openings as noted on the drawings.

F. Removal of defective existing roof drains and replacing/reworking drain components.

G. Other removals are necessary to accomplish the new work.

1.2 QUALITY ASSURANCE

A. Work shall be performed in strict accordance with the terms and conditions of all municipal and state regulations and local codes.

B. Demolition shall comply with the requirements of ANSI - American National Standard Safety Requirements for Demolition.

C. Conduct demolition work in a manner that will minimize disruption of Owner’s normal operations. Coordinate work activities daily with Owner.

D. Properly protect all facility surfaces and associated landscaping from damage due to normal demolition operations. Return all areas to their original condition at no charge to the Owner.

E. Drainage Testing: The contractor shall test each roof drain, downspouts/scuppers and other drainage elements for proper water flow before commencement of work. Commencement of work shall constitute acceptance of drainage device and any costs to unclog or repair these items shall be borne by the Contractor.

F. Do not remove existing roofing membrane or components when weather conditions threaten the integrity of building contents.

G. Field pull testing is required prior to commencing with work. All test results must meet the design pressures, manufacturer's requirements [deck/membrane resistance], requirements by the state building codes.

1.3 OCCUPATIONAL SAFETY and HEALTH ADMINISTRATION [OSHA]:

A. Walking working surfaces and fall protection standards, 29 CFR 1926.501 [b][1].

1.4 COORDINATION

A. All utilities and mechanical rooftop equipment will remain active during normal work hours, unless approved otherwise by the Owner.

B. All removals shall be legally disposed of, except those indicated to be reinstalled, salvaged or to remain Owner's property. Comply with hauling and disposal regulations of authorities having jurisdiction and EPA notification regulations.

1.5 FIELD CONDITIONS

A. Do not overload the structure with storage of materials, verify roof deck weight capacity and location of structural supports; only items needed that day shall be stored on the roof. Limit loads on roof to 25 pounds per square foot for uniformly distributed loads for metal / wood decks, 75 pounds per square for concrete decks. **Provide temporary securement of existing membrane to prevent membrane blow off while installing new roof system, if applicable.**

B. Do not apply the roofing system during inclement weather or when the chance of precipitation is 40% or greater, as listed on www.weather.com for the local area, when read at 7 AM local time or at time of work commencement. Proceed with roofing and associated work when weather conditions permit unrestricted use of materials and quality control of the work being installed.

C. Building space underneath roof work is utilized by on-going operations. Coordinate all work with the Owner including material storage and contractor parking. Owner's approval required before proceeding with the work. **Contractor must provide overhead protection for Owner's workers, public, visitors, etc from falling materials/debris at building entry points.**

1.6 **ALLOWANCES**.

A. Refer to Section 01 20 00.

PART 2 - **PRODUCTS**

NOT USED

PART 3 **- EXECUTION**

3.1 ROOF REPLACEMENT PREPARATION/EXAMINATION

A. All Roof Areas**.** Removal of all moisture, and other materials/debris from existing decking that inhibits new roofing materials from conforming to substrate, including power blowing of deck surfaces.

B. Verify that surfaces and site conditions are ready to receive work. Verify that deck is clean and smooth, free of depressions, irregularities, or projections and properly leveled, and the condition of the wood decking is suitable for re-roofing. Replace all damaged, deteriorated, rotted, or soft decking. Start of work constitutes acceptance of conditions.

C. Verify that all wood blocking, nailers are securely anchored in place.

3.2 DECK PREPARATION/REPAIRS

A. Wood Deck: Refer to Section 06 10 00.

3.3 DUST / FUME CONTROL

A. Take measures to avoid dust, dirt and debris from entering the building.

B. Throwing material off the roof is prohibited; provide an enclosed chute, crane or raised dump truck to remove roofing materials.

C. Provide a tarp and any or all other protection of walls / finish surfaces where material is being removed.

D. Take special precautions around deck penetrations, including but not limited to installation and removal of reinforced visqueen below the roof deck to protect property below.

E. Special precautions shall be taken to prevent fumes from entering the facilities through air intakes. Provide charcoal filters or other filtration media as necessary.

3.4 TRAFFIC

A. Conduct demolition operations and the removal of debris to ensure minimum interference with streets, walk and other adjacent facilities. Do not close or obstruct streets or walks, without permission from Owner and authorities having jurisdiction.

3.5 DISPOSAL OF MATERIALS

A. Remove from the site all debris, rubbish and other materials resulting from the demolition operations, are not being reused as soon as possible. The landfill used for disposal shall be approved for the type of materials being disposed of. Comply with local laws and EPA regulations when transporting materials from the site.

B. All materials that are to be reused in the new work shall be removed, cleaned and stored in a safe place until reinstallation, as applicable.

3.6 ASBESTOS REMOVAL / NOTIFICATION

A. If asbestos is found during the course of work, all removals shall be in accordance with written guidelines provided by OSHA Asbestos Construction Standard [29 CFR 1926.1101], and State, County and EPA guidelines as applicable. The contractor must be OSHA trained meeting the requirements of 29 CFR 1926.1101 for the removal, handling and monitoring of removed material. Transport and disposal of asbestos shall follow 40 CFR 61, Subpart A, 49 CFR 171 and 49 CFR 172. **No asbestos was found in the existing roof membranes.**

B. When applicable, indicate receipt and acceptance of hazardous wastes, such as asbestos containing materials, by a landfill licensed to accept such materials. Notify and provide all documentation to the Owner for disposal of asbestos. All costs for asbestos removal, permitting and handling will be included in the bid if noted herein. The owner will engage with an approved firm to provide an asbestos containing survey for the roof membranes that are to be removed in accordance with the contract documents. The results of this survey will be provided to the bidders prior to the bid due date.

C. All asbestos removals shall be done in a manner that does not cause the roofing fibers to become crumbed, pulverized, or airborne, these materials shall be handled as Category I and II non-friable asbestos. Should asbestos be encountered noted or not, that has become friable due to the actions of the Contractor or the condition of the material, the Contractor shall secure the services of an abatement contractor to remove the material and an independent firm to monitor removal activities and procedures [removal plan required]. The contractor shall pay for this abatement contractor if asbestos became friable due to their removal procedures. Notify Owner's rep if asbestos has been encountered that was not noted, prior to removal.

3.7 UTILITIES / EQUIPMENT

A. Where electrical lines, refrigerant line sets, equipment, controls, etc. interface with the performance of the work, they shall be temporality removed, replaced and made fully operational as soon as possible, a 48-hour notice and approval from Owner is required before any removals can take place. The Contractor has the responsibility to verify the operational status of all equipment before removals take place.

B. The Contractor must notify the Owner of any non-operational items prior to removal; commencement of work constitutes acceptance of equipment and any costs to make operational shall be borne by the Contractor.

END OF SECTION

SECTION 07 46 00 - FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fiber cement lap siding, fiber cement sheet siding, fiber cement trim, composite trim, flashings, accessories, and fastenings.

1.2 SUBMITTALS

A. Product Data: Submit data indicating materials, component profiles, fastening methods, jointing details, sizes, surface texture, finishes, and accessories.

B. Samples: Submit two samples illustrating surface texture and color.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 3 years' experience with installation of similar products.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Remodel mock-up area as required to produce acceptable work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 WARRANTY

A. Limited product warranty against manufacturing defects for 30 years, non pro-rated

PART 2 PRODUCTS

2.1 FIBER CEMENT SIDING

A. Non-asbestos fiber-cement siding to comply with ASTM C1186, Grade II, Type A; ASTM E 136, non-combustible materials.
   1. Hardie Artisan HZ5 lap siding.

B. Manufacturers:
   1. James Hardie [basis of design]
   2. Approved Equal.

C. Siding to meet the following building code compliance National Evaluation Report NER 405; US Department of Housing and Urban Development Materials Release 1263. Non-asbestos fiber cement siding to be non-combustible when tested in accordance with ASTM E136.

D. Lap Siding:

1. Hardie Plank Lap Siding HZ5 lap siding as manufactured by James Hardie Building Products, Inc.
2. Width: 8-1/4 inches with 7 inch exposure.
3. Length: 12 feet.
4. Finish: Smooth

E. Panel / Sheet Siding:
1. Hardie HZ5 Panels as manufactured by James Hardie Building Products, Inc. A non-combustible fiber-cement panel.
2. Product Composition: Grade II, Type A, fiber-cement sheets as defined by ASTM C1186. manufactured by the Hatschek process and cured by high pressure steam autoclaving.
3. Size and Profile: 48 inch x 96 inch sheets x .312 inch thickness
4. Finish: Smooth

F. Trim: Hardie HZ5 boards
1. Width: as noted on drawings.
2. Thickness: 3/4 inch and 1 inch as noted on drawings.
3. Finish: Smooth

G. Trim Accessories: As applicable to the installation

2.2 COMPOSITE TRIM

A. Exterior synthetic/composite trim, ASTM C 1185
1. Manufactured by Boral TruExterior Trim or Equal

B. Properties:
1. Density, ASTM C 1185, 40 to 50 pcf.
2. Water Absorption, ASTM D 570: Less than 1.5 percent.
3. Fungi Rot, AWPA E10:
   a. White Rot: Negligible Loss.
   b. Brown Rot: Negligible Loss.
4. Termite Resistance, AWPA E1: Greater than 9.0 with 10 being impervious.
5. Flexural Strength, ASTM C 1185: Greater than 1,600 psi
6. Nail Withdraw, ASTM D 1761: Greater than 50 lbf/in.
7. Coefficient of Linear Expansion, ASTM D 6341: 1.40E-05 in/in/degree F
8. Flame Spread, ASTM E 84: Between 25 and 29.
9. Smoke Developed, ASTM E 84: Less than 450.

C. Trim Sizes: Coordinate with drawings as applicable.
1. Exposed Texture: Smooth.

2.3 PRE-FINISHING

A. Factory applied primer system.

B. Field applied final paint coating, Refer to Section 09 90 00.

2.4 FASTENERS

A. Wood Framing: 16 gauge, galvanized ring shank nails or screws as applicable to the installation and meeting manufacturer requirements.

2.5 ACCESSORIES

A. Flashings: 26 gauge thick metal to match siding color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify framing conditions are within allowable tolerances without twists, bows, waves, etc.

B. Verify weather resistive barrier is installed and wall surfaces are ready to receive siding.

C. Nominal 2 x 4wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches face and straight, true, of uniform dimensions and properly aligned.
   1. Install water-resistive barriers and claddings to dry surfaces.
   2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
   3. Protect siding from other trades.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install water-resistive barrier.

D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

E. Install Weather Barrier in accordance with local building code requirements.

F. Install Seam Tape at joints, penetrations, and laps.

G. Install flashing where applicable in accordance with manufacturer's requirements.

3.3 INSTALLATION

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Install over braced wood. See General Fastening Requirements. Irregularities in framing and sheathing can mirror through the finished application. Correct irregularities before installing siding.

C. A water-resistive barrier (WRB) is required in accordance with local building code requirements. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

D. When installing horizontally, a WRB with min. 90 percent drainage efficiency shall be used.

E. Adjacent finished grade must slope away from the building in accordance with local building codes - typically a minimum of 6 inches. in the first 10 ft

F. Do not install that product remains in contact with standing water.

G. Installed on flat vertical wall applications only.

H. Install flashing around wall openings, etc.

I. Trim/Fascia and Rake
   1. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate a minimum of 3/4” into framing or full thickness of sheathing. Additional fasteners may be required to ensure adequate installation. Place fasteners no closer than 3/4” and no further than 2” from side edge of trim.
   2. Trim inside corners with a single board.
   3. Install single board at outside corner then align second corner board to outside edge of first board. Do not fasten trim board to trim board.
   4. Allow 1/8” gap between trim and siding.

J. Siding:
   1. Install materials in strict accordance with manufacturer's installation instructions.
   2. Install metal Z flashing and provide a 1/4 inch gap at horizontal panel joints.

3. Place fasteners no closer than 3/8 inch from panel edges and 2 inches from panel corners.
4. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
5. Maintain clearance between siding and adjacent finished grade.
6. Specific framing and fastener requirements refer to Tables 2 and 3 in International Code Council Evaluation Report No. ESR-2290.
7. Use off-stud metal jointer when vertical joints occur between framing members.

K. Align level, and plumb.

L. Install metal flashings at sills, head of wall openings, and all areas required by siding manufacturer.

M. Seal watertight.

3.4 FINISHING

A. Apply full finish field coating over the factory primed siding and trim. Refer to Section 09 90 00.

END OF SECTION

SECTION 07 53 00 – SELF-ADHERED EPDM ROOFING, INSULATION AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDES, BUT NOT LIMITED TO:

General: Intent of project is to provide a functional 20-year new watertight roof system, resisting wind uplift pressures, thermally induced movement and exposure to weather without failure. Roof system must have been tested by an approved testing agency and have field experience by the manufacturer. Provide and install all roof components and accessories for a complete watertight roof system.

A. Clean and dry deck surface [repair / replace decking as required by field conditions].

B. Installation of a new EPDM roofing system, self-adhered system [see roof schedules].

C. Installation of new flat stock and tapered insulation, tapered insulation saddles.

D. Installation of new membrane flashings and roof accessories.

E. Raising existing curbs on mechanical units, vents, etc and rework, disconnect/ extend ducting/ electrical /gas lines to accommodate new insulation heights, flashings, penetration covers, and sheet metal as required. Electrical connections/utility hookups removed and reinstalled by Electrical contractor. Purge and recharge all removed HVAC units by HVAC contractor.
   1. All work required for plumbing, mechanical, and electrical disconnect and reconnect, rework, etc. as necessary for the proper execution of the work shall be included within the Contractor's scope – this will NOT be accomplished by the Owner, unless specifically noted.
   2. Sub / Trade Contractors must be approved by Owner. In some cases, there may be maintenance contracts, preferred vendors who work on the building and understand the intricacies of the existing building systems that must be utilized.

F. Installation of new A/C condenser unit stands, curbs and other roof top units stands, curbs etc. includes approved tie down/stands, as shown, as applicable.

G. Installation of roof pavers.

H. Installation of walk pads.

1.2 APPLICABLE REFERENCES

A. The following references form a part of this specification.
   1. ASTM C 1289-13 Polyiso Insulation Board, Type II, Class 2, Grade 2 and HD Cover Board, Type II, Class 4, Grade 1
   2. ASTM E108 Fire Test of Roof Coverings.
   3. [FMG] Factory Mutual Global - Current Approval System [NAV assembly numbers], Loss Prevention Data Sheets for Roof Deck Securement for Above Deck Roof Components, Perimeter Flashings, Wind Design-ANSI/FM 4474, Approval Standard FM 4470 and Roof Loads for Construction
   4. [UL] Underwriters Laboratories - Roofing Materials and Systems Directory, Fire Resistance Directory, Current Edition.
   5. [NRCA] National Roofing Contractors Association - Current Roofing and Waterproofing Manual.
   6. [AISC] Manual of Steel Construction
   7. [OSHA] Occupational Safety and Health Administration, Guidelines
   8. [ASCE] 7-10 Minimum Design Loads for Buildings
   9. [ANSI/SPRI/FM] 4435 ES-1 Wind Design for Edge Systems
   10. [NFPA] National Fire Protection Association, 58 Liquefied Petroleum Gas Code
   11. [ANSI/SPRI] WD-1 Wind Design Standards
   12. ANSI/SPRI] Field Uplift Resistance of Fasteners and Adhesive.

13. ASTM D4637, Type 1 Ethylene Propylene Diene Monomer [EPDM].
14. ASTM D1177 Gypsum Board

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing EPDM roofing membranes specified in this section, with minimum 10 years' experience.
   1. All roofing materials supplied must be manufactured or manufacturer approved by the company furnishing the warranty including the metal roof edge and coping [if integrated in the roof membrane] - **single source responsibility**. The manufacturer must manufacture the membrane material furnished as a minimum.
   2. The roofing material manufacturer [manufacturer of record] must submit a letter stating that the applicator is approved to use the products as furnished, is licensed to install their material in the state in which the project is located, that the applicator can obtain the warranties as outlined in the specifications in accordance with the roof system requirements and details as drawn and the products are acceptable for use on the surfaces to which they are being applied. In addition, an outline of the roofing system components product name and their securement requirements shall be included with the letter.

B. Applicator: Company specializing in applying single ply roof systems with minimum 5 years documented experience, never been terminated by a manufacturer for workmanship problems, be approved for minimum 5 years by the manufacturer for use of their materials and can provide the warranties as specified. No deviations from the roof membrane products specified herein unless approved by the owner.

C. Inspection: Prior to, during mid-point installation and at completion, an inspection shall be made by the manufacturer's representative to assure that the roofing system is/has been installed in accordance with their requirements and recommendations.
   1. An inspection status report at mid-point of construction shall be prepared by the manufacturer's rep, no later than 3 days after the inspection and provided to Architect.

D. Training: The roof foremen or at least 1 assistant working on this project must either be a 'Journeymen Roofer' or have attended and completed the roof material membrane manufacturer's approved installation course herein within the last two years of the bid date with the membrane/s specified herein. [**Certificate of proof required or letter from manufacturer as part of the submittal]**. Roof foremen must have a minimum of 5 years' experience with application of EPDM roof systems and be able to interpret specifications and drawings [Contract documents must be always on-site].

E. Drainage Testing Requirements: Refer to Section 01 45 23

F. Provide waterproof tarp[s] on site for temporary protection in the event of sudden inclement weather.

G. Provide any power necessary to accomplish the work, Owner may or not provide power.

H. Existing membrane penetrations or leak sources within work area must be repaired watertight before commencement of new work.

I. Locate any conduit / lines which may be located directly under the deck prior to using penetrating deck fastener to avoid puncturing lines. Coordinate inspection with Owner. Relocate [at Owner's expense] any conduit / lines necessary. Repair any conduit / lines which are damaged / penetrated at Contractor's expense].

1.4 REGULATORY PERFORMANCE REQUIREMENTS

A. Fire Hazard Classification: Underwriters Laboratories [UL], Use only Class A fire-rated materials as tested in accordance with ASTM E 108 or UL 790 for exterior fire. The roof system must be a Class A rated system.

B. American Society of Civil Engineers [ASCE], Factory Mutual Global Corporation [FMG], Roof Material Manufacturer, NRCA: Materials must meet the intent of the test criteria set forth in FMG/ANSI standard 4474 and ANSI/SPRI WD-1 to resistance the uplift wind design pressures as noted on the drawings, to support internal/external fire, to support corrosion resistance fasteners/anchors. The roof membrane manufacturer in compliance with the building code and FM NAV assembly if required must provide the roof assembly securement requirements to resist the wind pressures as noted along with meeting the roof warranty wind requirements and other requirements as shown and outlined in the specifications. The manufacturer's roof assembly securement must not be less stringent than the ASCE 7-16 calculations and must be successfully tested to resist wind uplift pressure according with ANSI/SPRI WD-1 standard. A field pull [ANSI/SPRI FX-1] or adhesion test [ANSI/SPRI 1A-1] will be necessary prior to commencing work when conditions are different then manufacturer's assembly test criteria for their approval to meet the design pressures or required by the building code or be conducted per Architect's request. If a test has been completed the results will be provided herein.

C. Occupational Safety and Health Administration [OSHA] 29CFR 1926:
   1. Asbestos roof materials training for the removal, handling and monitoring.
   2. Roofing safety requirements for torch application.
   3. Walking working surfaces and fall protection standards.

1.5 **STATE/FACTORY MUTUAL [FM] APPROVALS AND STANDARDS** *[these approvals/standards reference the design products contained herein. Equal products must provide applicable product approvals]. Approvals and numbers must be verified by the manufacturers technical department.*

A. AMERICAN SOCIETY OF CIVIL ENGINEERS - Minimum Design Loads for Buildings and Other Structures.
   1. ANSI/ASCE Revision 7-16 - refer to wind pressure zones on the drawings.

1.6 COORDINATION

A. Daily reporting by the Contractor is required.
   1. Email project team daily with outline summary of work accomplished, any problems encountered such as bad deck, etc.
   2. Email project team on days when weather prohibits work to indicate a 'weather day.'

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not overload the structure with storage of materials, verify roof deck weight capacity and location of structural supports, only items needed that day shall be stored on the roof. Limit loads on roof to 25 pounds per square foot for uniformly distributed loads for metal/wood decks, 75 pounds per square for concrete decks. Provide temporary securement of existing membrane to prevent membrane blow off while installing new roof system.

B. Store and protect products in accordance with manufacturer's instructions.

C. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact. All materials must be UL or FM labeled.

D. Store products in weather-protected environment [manufacturer's plastic wrap is accepted for proper protection, unless wrap is broken, torn, removed], clear of ground 4 inches min. and moisture. Use breathable tarps for moisture protection as needed. Protect unwrapped foam insulation and liquids from direct sunlight exposure. Water damaged materials will be marked 'rejected' by the Contractor/Owner or Architect and removed from the site.

E. Storage of flammable liquids in buildings is prohibited. All combustible debris shall be removed from the site daily.

F. Storage shall be in areas designated by Owner.

1.8 WEATHER CONDITIONS

A. Do not apply the roofing system during inclement weather or when the chance is 40% or greater, percentage as listed on www.weather.com for the local area, percentage as listed when read at 7 AM local time or at time of work commencement. Proceed with roofing and associated work when weather conditions permit unrestricted use of materials and quality control of the work being installed.

B. Do not apply roofing system to damp or frozen deck surface.

C. Adverse weather conditions e.g. extreme temperature, high winds, high humidity, and moisture could have a detrimental effect on adhesives, contact manufacturer for acceptable tolerances. See additional restrictions specified herein.

1.9 SEQUENCING AND SCHEDULIING

A. Building space underneath roof work is utilized by on-going operations. Coordinate all work with Owner including material storage and contractor parking. Owner's approval required before proceeding with the work. Contractor must provide overhead protection for Owner's workers, public, visitors, etc from falling materials/debris at building entry points.

B. Coordinate the work of installing all associated items in such sequence that will not necessitate movement of workers and equipment over completed roof areas.

C. Sequence daily work of new roofing to be limited only that can be covered and made 100% watertight at the end of each day, including full adhesion of the membrane, flashings and night seals. No temporary roofing shall be allowed unless approved by the owner.

1.10 MANUFACTURER'S WARRANTIES

A. Provide a manufacturer's warranty for both repairs/replacements due to any faults in the material and workmanship [Total System Responsibility]. Any leak repairs/replacement due to normal wear and tear, membrane defects, workmanship defects, damage due to wind speeds up to 72 mph [10 meters above ground], shall be performed at no charge to the Owner throughout the period of the warranty. Roof warranty shall be a no dollar limit type [NDL] with no penal sum, covering all insulation, fasteners, membrane, flashings, liquid flashing, metal coping/edging, regardless of the manufacturer. The warranty must be transferable and must be signed by the Manufacturer of record and the Owner, if required. When a contractor warranty is provided or implied, this warranty must bind the Manufacturer and Contractor, for the terms of their agreement, to perform any necessary repairs/replacements for the term of the contractors warranty [in most cases two years].
   1. .060-inch-thick EPDM Roof Membrane shall be warranted for [20] twenty years.

B. In the event of a default by the Contractor, the Manufacturer will provide a new contractor to fulfill the warranty obligation.

1.11 PORTABLE FIRE EXTINGUISHERS

A. Two standard listed multipurpose dry chemical fire extinguishers, NFPA 10, with 10-pound capacity and an ABC UL rating shall be provided and located 20 horizonal feet from the work area. Additional fire extinguishers shall be provided for different roof levels/work sites.
   1. Ensure all personnel are trained to use fire extinguishers.

PART 2 PRODUCTS

General: All products shall be Building Code approved as applicable, meeting all manufacturers full system roof warranty requirements.

2.1 ROOFING SYSTEM DESCRIPTIONS

General: System Assembly Applications/Scopes, Roof Removal and Replacement.

A. Manufacturers and Membrane Products and Membrane Designation: [Single Ply]: Ethylene Diene Monomer [EPDM] .060 inches thick, non-reinforced, self-adhered, color black.
   1. Elevate, RubberGuard EPDM SA.
   2. Carlisle SynTec., Sure-Seal EPDM, SAT with factory applied tape.
   3. Johns Manville, EPDM FIT SA

B. Insulation [polyisocyanurate] Manufacturers:
   1. Elevate, ISO 95+GL
   2. Carlisle SynTec, InsulBase
   3. Johns Manville, ENRGY 3

C. Base Flashing Designations: same as roof system unless manufacturer requires a different product for their warranty or as noted herein. Use manufacturer approved liquid membrane system product for flashing conditions where flashing height is less than 6 inches and unusual shaped metal supports and other areas as required by the manufacturer where noted or as required by condition. Use manufacturer approved molded products where liquid flashing system will not provide a watertight condition.
   1. Other Flashing Designation- Manufacturer's approved details for 20-year warranty.

Contractor's quote must match the roof system including all components and application procedures [cover board, fasteners, membrane and etc.] The roofing schedules set the parameters for the roof system assembly and its application procedures.

ROOFING SYSTEM SCHEDULES

ROOF SYSTEM [EPDM]

Low Sloped Wood Deck [Roof Areas A-1, A-2, C-2, and C-2]

Deck:	OSB deck [sloped]
Preparation:	See Preparation for Reroofing and the proposed roof matrix.
Vapor Barrier:	None
Insulation:	One-layer, flat stock, 1.5 inches thick, fastened into the wood deck at the fastening rates established by manufacturer for warranty. Provide tapered insulation saddles where required.
Cover Board:	None.
Membrane:	One ply EPDM membrane, self-adhered to the new cover board.

ROOF SYSTEM [EPDM]

Flat Wood Deck [Roof Areas B-1, B-2, B-3, B-4, B-5, B-6, and B-7]

Deck:	OSB deck [flat]
Preparation:	See Preparation for Reroofing and the proposed roof matrix.
Vapor Barrier:	None
Insulation:	1/8 inch per foot tapered insulation system [full tapered design], starting thickness of 1/2 inch, fastened into the wood deck at the fastening rates established by manufacturer for warranty. Provide tapered insulation saddles where required.
Cover Board:	None.
Membrane:	One ply EPDM membrane, self-adhered to the new cover board.
Overburden:	Rubber / Composite Roof Deck Pavers

2.2 SHEET MATERIALS/COMPONENTS

General: all membrane component flashings, etc shall match the same color as the membrane.

A. Elastomeric Sheet: ASTM D4637, type I, class A material, cured, synthetic, non-polyester reinforced, self-adhered, single ply membrane composed of Ethylene Propylene Diene Monomer [EPDM], BLACK, .060 inches thick.

B. Membrane Flashing: ASTM D4811, Type II, .055 -.060 inches thick, black, non-reinforced, semi-cured, synthetic, single ply EPDM.

C. Self-Adhesive Flashing: un-cured .045 inches thick, EPDM membrane laminated to 35 mil EPDM tape adhesive.

D. Lap Splice Tape: .035 inches thick, EPDM-based, formulated for compatibility w/EPDM membrane, self-adhering, cured, width as required.

E. Adhesive Primer: Solvent based synthetic rubber based formulated for compatibility w/EPDM membrane.

F. Splice Adhesive: Synthetic polymer-based, if required.

G. Bonding Adhesive: Primer for vertical surfaces.

H. Water Block Seal: Butyl rubber sealant.

I. Splice Cleaner: Organic solvent mixture.

2.3 INSULATION AND COVER BOARD

General: All flat stock, tapered insulation and / or cover board shall be from the same manufacturer. Board configuration: 48-inch x 96-inch thickness [mechanically fastened] or 48-inch x 48-inch thickness for adhered [adhesive] applied. Board configuration for tapered insulation: 48-inch x 48-inch. Mixing of insulation panels from different manufacturers is not acceptable. All insulation/cover board shall be supplied and approved by the membrane manufacturer and must meet FMG 4450 or UL 1256 as a tested assembly.

A. Flat Board Stock: ASTM C1289, closed cell polyisocyanurate, square edge/rigid board, type II, class 2, **grade 2**, coated bonded inorganic glass fiber reinforced mat facers on both sides, square edges, **minimum 20 psi compressive strength**, size boards as approved for application and by the roof membrane manufacturer.
   1. Includes in-fill for tapered saddles and/or insulation. Thickness as outlined.

B. Tapered: ASTM C1289, closed cell polyisocyanurate rigid board; type II, class 2, **grade 3**, coated bonded inorganic glass fiber reinforced mat facers on both sides, factory tapered, **minimum 25 psi compressive strength**, size boards as approved for application and as supplied by the roof membrane manufacturer. The roofing contractor and the tapered insulation manufacturer designer must assume design/application responsibility for the performance of the submitted tapered insulation layout.
   1. **Tapered and Saddle insulation** shall be sloped at 1/8 inch per foot. *Tapered insulation starts at 1/2 inch thick. Tapered insulation saddles starts at 1/2 inch thick.*
   2. Saddles: Each side of the saddle width shall be as shown or 25% of the drain to drain [whatever is less], if spanning between two or more drains as applicable for conditions.
   3. Drains Sumps: Tapered min. 1/4 inch per foot slope drain sumps are required at all drains, if conditions allow [size, 4-foot square].

2.4 CANTS / EDGE

A. Cant Strips and Tapered Edge Strips: Perlite, fire resistant, performed to 45 degree angle and 18 inch long tapered edge strip, tapered front to back as required by the Manufacturer.

2.5 ROOF FASTENERS AND ACCESSORIES *[some items may not be required for this project]*

General: Fasteners/Anchors: strength, type and configuration must meet the required pull test resistance for each attachment application. Fastener's rate and pattern must be FMG, or building code approved to meet the intent of the wind uplift rating specified.

A. The Contractor shall determine fastener lengths,
   1. Minimum embedment:
      a. Steel: 3/4-inch
      b. Concrete/concrete block: 1-1/4 inch
      c. Gypsum: 2-inch,
      d. Tectum: 2-inch
      e. Wood: 1 1/4 inch.
   2. Fastener manufacturers: ITW Buildex, IWT Red Head, OMG and Tru-Fast or equal.
   3. All fasteners shall be corrosion resistant steel in accordance with ASTM F1667 or type 304 -316 stainless.

B. Summary of fasteners and requirements are as follows:
   1. Roofing and Other Nails: square or round head, ring shanked galvanized or non-ferrous type, length and diameter as required to suit application.
   2. Metal Counterflashing and other LG metal sheets to Wood: ITW Buildex, 'TruGrip, #9, self-piercing, corrosion resistance steel shank with EPDM washer.
   3. Metal Counterflashing and Other LG Sheet Metal [exposed] to Masonry: ITW Buildex, 1/4 inch, 'Scots Tapcon', stainless steel-hex head, ATF treads, corrosion resistant steel shank, with EPDM washer.
   4. Termination Bars [exposed] to Masonry: ITW Buildex, ¼ inch, 'Scots Tapcon', stainless steel-hex head, ATF treads, corrosion resistant steel shank, with EPDM washer.
   5. Metal Sheets or Metal Decking to Metal Decking: # 10 ITW Buildex,' tek/ 1', hex washer head, ATF self-tapping with corrosion resistant steel shank.
   6. Base Sheet, Cover Board, Membrane to Insulating Concrete, Gypsum or Wood Fiber Decking: Tru-Fast, Twin Loc-nail, Coated steel fastener assembled with a 2.7inch diameter coated plate with a stainless-steel locking staple.
   7. Insulation Fasteners/Plate, Wood Deck: Steel, HD #14, red, phillips head, superior corrosion resistance with a 3-inch round metal cap, meeting FMG 4470 standard requirements and must be supplied or approved by the roofing manufacturer for their warranty.
   8. Edge Securement [EPDM]: Reinforced perimeter fastening strip RTS, 6 in. wide, .045 in. thick, polyester scrim reinforced, with factory laminated self-adhering tape, fastened in place to the wall or the deck at 12 inches on center with manufacturer approved fasteners and plates.
   9. General Purpose Stainless Steel: Series 304 fasteners, with or w/out EPDM washers.

C. Summary of accessories items and requirements as follows:
   1. Pre-Molded Manufactured Accessories: Molded EDPM, color to match field, .050-.075 inch thick, pipe flashings, etc. Manufacturer warranted accessories.
   2. Walkway Pads: Non-Reinforced EPDM, 0.130 inches thick, size: 30-inch-wide x 40 feet long with patterned slip resistant bearing surface, self-adhered or factory applied tape.
   3. Roof Pavers: Refer to Section 07 76 10
   4. Termination Bars: Aluminum 1.3-inch-wide, 10 feet long, 1.08 inch [min.] thick bars with flat or with [integral caulk edge], as applicable per manufacturer.
   5. Pipe Supports/Hangers:
      f. Manufactured by Portable Pipe Hangers, Adjustable, stainless metal components, polypropylene base, 'type SS8 – C or R [up to 2 ½ inch pipes] or PP10' [up to 3 ½ inch pipes], as required for conditions.
      g. Manufactured by OMG, Pipe-Guard, non-adjustable, PGM-BK, PGS-BK, PGTS-BK pipes up to 2 inches, as required for conditions.

h. Manufactured by Advanced Supports Products, EcoCurb or MIRO pillow block. Pipe supports Condensate Lines/Piping.

6. Rail Curbs: Manufactured by Pate, type es-1, es-2 or es-5, as required for condition, size as required by unit base size including unit tie downs or as shown.
7. Vent Pipe Extenders: Manufactured by Tubos, Clearwater, FL, PVC pipe extenders.
8. A/C condenser and other roof top unit stands: Manufactured by Precision Aluminum Products, with height/load requirements provided including engineered tie downs and deck/substrate anchoring requirements.

2.6 SEALANTS/TAPES

A. General Use: ASTM C920, Type S, Grade NS, Class 25 as required for each joint condition, single component, elastomeric silicone polymer, non-staining, non-shrinking, non-sagging, and ultra-violet resistance, clear or to match surrounding existing color.
   1. Refer to section 079201 Sealants for Roofing.

PART 3 EXECUTION

3.1 EXAMINATION / LEVEL SURFACE CONDITIONS

A. Verify that surfaces and site conditions are ready to receive work. Verify that deck [total removed roofing membrane sections] is clean and smooth, free of depressions, irregularities, or projections, properly leveled, start of work constitutes acceptance of conditions.
   1. Verify that all wood blocking, nailers are securely anchored in place.

B. Areas of substrate where severe ponding [1inch deep or greater] will occur 48 hours after a rainfall with an outside average temperature of 65F or higher [partly sunny or sunny condition] shall be levered per manufacturers recommendation and identified to RDA prior to installing final membrane. Failure to perform this action could result in total roof removal at that ponding area, string leveling prior to final ply recommended.

3.2 PROTECTION

A. Protect building surfaces/interior spaces against damage from roofing work. It is the Contractor's responsibility to take any necessary actions to prevent construction-related leaks, to include but not limited to repairing watertight existing surrounding roofing scheduled to be replaced or overlaid. Surround roofing areas include roof top material storage areas, workers roof top access to from roofing work site areas and any drainage system [roof drain-scuppers] leak issues located in work area. Contractor must include the cost to deal with these existing leak sources into the overall project unless the Owner/Owners rep is made aware of these leak sources prior to commencement of the project.

B. Provide, erect barricades and guardrails as required by applicable regulatory advisory to protect occupants of building and workers.

C. Cover all drains and other openings intended for drainage during construction to prevent clogging of system, remove at the end of each day to allow for drainage.

D. Special precautions shall be taken to avoid fumes from entering the facilities through air intakes, coordinate with owner to deal with active A/C units.

3.3 INSULATION APPLICATION

General: Secure insulation to roof deck to the requirements of FMG loss Prevention Data Sheet 1-28 and 1-29 to include additional securement at the corners and perimeters. Install insulation including saddles [if required] as shown on the contractor/manufacturer-approved layout. This layout must be capable of draining the roof completely into drainage elements after 48 hours following rainfall with an outside average temperature of 65For higher [partly sunny or sunny conditions]. The layout pattern must not block the flow of rainwater into any roof top unit/ventilator.

A. Wood Deck: Fasten the insulation in a one-layer configuration onto the deck at the rate/pattern as tested/approved by the manufacturer and to meet FM requirements. All insulation shall be installed in accordance with the Manufacturer's / Contractors/ Architect approved layout. Install insulation with long joints in a straight line with end joints staggered. Install the insulation perpendicular to roof slope to the new insulation board with joints staggered [as applicable] no less than 24 inches in all directions from joints below in accordance with windstorm resistance classification securement pattern and insulation manufacturer's instructions. Any portion of an insulation board that falls within the calculated perimeter or corner area has the increased securement applied over the entire board. Offset joints of top insulation layers/cover board from bottom layers/saddles no less than 6 inches. Full tapered insulation system where tapered boards are on top require no offset.

B. Level all decks as necessary prior to starting work.

C. Apply no more insulation than can be sealed watertight with roofing membrane in the same day. Cut insulation to fit neatly to perimeter blocking and around penetrations through the roof, maximum joint width 3/8 inch.

D. All ventilators, A/C unit curbs, supports etc. [square or rectangle] will have a tapered edge strip [formed as a saddle] placed around the high side of unit to slope water from unit. Ventilators, A/C unit, supports etc. curbs over 2 feet wide will require insulation saddles sloped 1/2 inch per foot.

E. Provide adequate separation of insulation between hot exhaust stacks.

3.4 MEMBRANE APPLICATION

General: Install roofing sheets as per manufacturer's recommendations which may be slightly different than outlined due to weather conditions and the following summary of requirements. Only install membrane when outside temperature of 30-degree F or higher. Additional enhancements to the membrane will be required if a 30-year warranted system is specified herein, consult the manufacturer for these requirements. These requirements are in addition to what is specified herein.

A. Beginning at the low point of the roof, place the membrane without stretching over the acceptable substrate and allow membrane to relax a minimum of 30 minutes before attachment or splicing.

B. After making sure the sheet is placed in its final position seams shed water or parallel to the water flow, adjoin sheets in a manner that all lap seams along the length of the membrane overlap 3 inches for application of seam tape and 1 inch or butt at end laps. The membrane should be smooth, clean and free of wrinkles and buckles.

C. Starting from the center split of the exposed release liner, remove the release liner on one half of the sheet. Remove the liner on both sides at a 45-degree angle beyond the membrane edge. Pull the membrane onto the coverboard at an angle avoiding wrinkles and adhere it to the cover board. Do not fold the length of the roll in half. Keeping the membrane flat and secured and seams aligned continue removing the release liner. Removal of the liner should be accomplished by two people to use the slide out method or if cold condition exists use the barn door method. Fold back the remaining half of the sheet and repeat the process.

D. Use a stiff bristled broom and apply pressure to initiate adhesion and push air out from the sheet. Broom the installed membrane across the width working towards the outer edge. Use a 50-pound weighted roller to roll membrane after broom has been completed.

3.5 MEMBRANE SPLICING

[Factory Applied Tape] Position the sheet at the splice area by overlapping membrane. Tack the sheet back with primer at 5' centers and at factory splices or as necessary to hold back the membrane at the splicing area. Remove excess amounts of dusting agent on the sheet and at factory splices using a stiff push broom. Apply primer to both surfaces at the same time to allow the same flash off time. Additional scrubbing is required at areas that may have become contaminated or have excess amounts of dusting agent, and at all factory splices. Follow manufacturers guidelines if no factory tape is applied.

A. Position the seam splice tape on the bottom sheet, aligning the edge of the release paper with the markings. When adhering factory adhered tape, pull the backing from the tape and allow the top sheet to fall freely onto the exposed primed surface. Immediately roll the splice tape with a 3 inch-4-inch-wide silicone or silicone sleeved steel hand roller or a short nap 3-inch paint roller.

B. When the seam splice tape has been installed for the entire splice length, trim the top sheet as necessary to assure that 1/8 inch-1/2 inch of the seam splice tape will be exposed on the finished splice. Broom the entire length of the splice as the release paper is being removed.

C. Roll the splice using a 1-1/2 inch-2-inch-wide silicone or silicone sleeved steel hand roller, first across the splice, and then along the entire length of the splice.

3.6 FLASHING APPLICATIONS – Vertical Surfaces, etc.

General: Secure membrane when there is an angle change greater than 2 inch 12 inches with a reinforced perimeter fastening strip [RPS] fastened to the deck or wall, see manufacturer's recommendations for exceptions.

A. Remove loose or unsecured flashings, mineral surfaced or coated flashings and excessive asphalt to provide a smooth, sound surface for new flashings.

B. Apply primer to wall surface allow to dry. Roll the field EPDM membrane up the vertical surface evenly and carefully to minimize wrinkles.

C. Install T-Joint covers at field and other splice intersections as required by manufacturer. Apply tape at laps if membrane is not self-adhered type throughout out the sheet [edge to edge].

D. Provide termination directly to the vertical by a termination bar set in water block seal and other requirements as shown on the drawings.

3.7 FLASHING APPLICATION - Edge, Pipes and Drains.

General: Install flashing sheets over cants strips and other vertical surfaces, at edges and penetrations through roof as per manufacture's recommendations, requirements of FMG loss Prevention Data Sheet 1-49 including details and the following requirements**.**

A. EDGES
   1. Apply primer to the metal edging and membrane. Remove approximately 2 ft.-3 ft. of release paper from the seam flashing and apply to the metal flange and membrane. Lap adjacent rolls of seam flashing a minimum of one inch with a 2 inch-3-inch-wide silicone or silicone sleeved steel hand roller, roll the seam flashing ensure proper adhesion. Additional attention must be given to factory splice intersections and to any change in plane.

2. Apply 6-inch length of seam flashing, a seam Joint Cover, or 6-inch x 6-inch form flash to the inside edge of the seam flashing at all overlaps and at all intersections between the seam flashing and field fabricated splices.
3. Apply seam edge treatment at the intersections of the flashing sections.
4. If the roof edge includes a metal edge and sealant is not applied between the laps in the metal edging, an additional piece of seam flashing shall be applied over the metal lap to the top of the metal edge, after the initial application of seam flashing. Seam edge treatment shall be applied at the intersections of the two flashing sections.

B. PIPES
1. Flash pipes with manufactures pre-molded flashing to max. extent possible or form flash only when per-molded flashing is not available. Prime and install an additional 12-inch seam flashing over pre-molded flange.

C. DRAINS
1. Remove all existing flashings, leads and cement. Provide a clean even finish between the drain clamping ring and the drain bowl. Position the membrane and cut a hole for the roof drain allowing a ¾ inch membrane inside the clamping ring. Make round holes in the membrane to align with the bolts. Install water block seal on the clamping ring flange below the membrane. Tighten the clamping bolts to achieve a constant compression. Replace or repair [bolts broken, cannot be removed] drain where existing clamping ring cannot be bolted securely in place.

3.8 LIQUID FLASHING

A. Liquid flashing [LF] system [PMA] shall be installed on a clean roof surface with a reinforced polyester fleece fabric in a multi-layer [resin/fleece/resin] configuration with PMA resin applied [fully saturating fabric] at 2 gallons per square feet with resin top coat, Extending vertically and 8 beyond the base of penetration. LF shall be installed where noted or as required by condition per the manufacturer. Install in accordance with manufacturer's printed detail or as shown.

3.9 INSTALLATION OF ROOF ACCESSORIES

A. Walkway pads and other accessories shall be installed in accordance with the manufacturer's recommendations or as shown on the drawings. Space pads 3 inches apart.

B. Expansion joint, and other accessories not noted herein shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings.

C. Rail curbs, equipment stands, and pipe supports shall be installed in accordance with the manufacturer's instructions. Anchoring to substrate and tie downs as shown. Place curbs on deck and position curbs ends to allow water to flow toward drains or gutters.

D. Equipment enclosure shall be 24-gauge stainless steel, shop or pre-manufactured with top fabricated [angled] to allow no moisture from entering the pipe areas. Install mortar in the bottom of base with polyurethane pourable sealer poured around pipes [2-inch depth minimum]. Seal pipes that exit enclosure with sealant/foam.

E. Penetration pans shall have mortar installed in the bottom of pitch pans with polyurethane pourable sealer [2-inch min] filled to the top of the pan, then slope.

F. Roof drain clamp rings/bolts where distorted, corroded or to short, shall be replaced. Clamp rings shall be clean of all asphalt and other deposits. Provide new drain strainers where missing. Install drain inserts if clamping rings cannot be compressed on the new roof membrane due to broken bolts, etc.

G. A/C condenser and other roof top unit stands shall be installed in accordance with engineered requirements furnished by the manufacturer to include height/load, tie downs and deck/substrate anchoring requirements.

3.10 FIRE SAFETY

A. Measures to be implemented by the contractor to minimize the possibility of fire and to provide a safe work environment. It is the responsibility of the contractor performing any work to comply with the safety provisions of the National Fire Codes pertaining to such work along with other requirements specified herein. In the event of a fire of any size, Contractor shall notify the Local Fire Department.

3.11 WATER CUT-OFF

A. At the end of the day's work or when precipitation is imminent, a water cut-off or other waterproof protection shall be provided to ensure a watertight condition is obtained, between the new and existing conditions, remove cut-off prior to resuming the installation of the roofing system.

B. Contractor is responsible for the design and implementation of the night seal / water cut-off. Provide plan / implementation to Architect / Owner for review.

3.12 CLEANING

A. In areas where finished surfaces are soiled by any other source of soiling caused by work of this section, consult manufacturer for cleaning advice.

END OF SECTION

SECTIONS 07 62 00 - SHEET METAL FLASHING, TRIM AND SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDES BUT NOT LIMITED TO:

General: Intent of project is to provide new sheet metal components for a new roof replacement. Install all components, including sheet metal items, accessories of the new roof system needed for a completed watertight installation.

A. Removal of existing sheet metal items as noted. Refer to section 07 01 50 Preparation for Reroofing.

B. Installation of new sheet metal items:
1. Wind-rated coping, fascia/cover and edge, ANSI/SPRI/FM ES 1, tested and approved.
2. Sheet metal fasteners.
3. Skirt / Bib flashing [around units and curbs], counter flashing, and other sheet metal items.
4. Thru wall scuppers, conductor heads, and downspouts.
5. Equipment support flashings.
6. Equipment enclosures

1.2 APPLICABLE REFERENCES

General: The following references form a part of this specification.
1. ASTM A 653 Metallic Coated, Sheet Steel [Galvanized], Grade A, Hot Dipped, Zinc Coated, Coating Class G90.
2. ASTM A 792, Metallic Coated, Sheet Steel [Galvalume], Grade 40, Coating Class A250 [Galvalume] Zinc Alloy.
3. ASTM A 755, Pre-Finished, Sheet Steel [Galvanized/Galvalume], Grade 40, Coating Class A250 or G90, Pre-painted by the coil coating process.
4. ASTM B 209, Aluminum.
5. ASTM D 1970 Self-Adhered Membrane
6. ASTM E 108 Fire Test of Roof Coverings.
7. ASTM E 2112 Installation of Exterior Door Flashings.
8. [FMG] Factory Mutual Global - Current Approval System [NAV assembly numbers], Loss Prevention Data Sheets for Roof Deck Securement for Above Deck Roof Components, Perimeter Flashings, Wind Design-ANSI/FM 4474, Approval Standards for Roof Materials FM 4470 and Roof Loads for Construction
9. [UL] Underwriters Laboratories - Roofing Materials and Systems Directory, Fire Resistance Directory, Current Edition.
10. [NRCA] National Roofing Contractors Association - Current Roofing and Waterproofing Manual, including shop fabricated metal edge testing.
11. [AISC] Manual of Steel Construction
12. [SMACNA] Sheet Metal and Air Conditioning Contractors Association-Current Manual.
13. [OSHA] Occupational Safety and Health Administration, Guidelines
14. [ASCE/SEI] 7-16 Minimum Design Loads for Buildings
15. [ANSI/SPRI/FM 4435] standard ES-1-17 Wind Design for Edge Systems
16. [NFPA] National Fire Protection Association, 58 Liquefied Petroleum Gas Code
17. [ANSI/SPRI] WD-1 Wind Design Standards.

1.3 QUALITY ASSURANCE

A. Fabricator/Installer: Company specializing with skilled workers in sheet metal with minimum 5 years documented experience, never been terminated by a manufacturer for workmanship problems and be capable of providing the warranties as specified.

B. Sheet Metal items and installation shall comply with SMACNA's [Architectural Sheet Metal] and NRCA's [Roofing] current manuals.

1.4 COORDINATION

A. Coordinate sheet metal flashing, trim layout installation with adjoining roofing to provide a leakproof, secure non-corrosive installation.

1.5 PERFORMANCE REQUIREMENTS

A. Fire Hazard Classification: Underwriters Laboratories [UL], Use only Class A fire-rated materials as tested in accordance with ASTM E 108 or UL 790 for exterior fire.

B. Install sheet metal items to withstand wind loads, structural movement, by preventing buckling, opening of joints, hole elongation, failure of joint sealant, failure of connections and other detrimental effects.

C. All perimeter metal items [copings and edges] must have been tested to resist the wind design loads for the building.

1.6 DELIVERY, STORAGE and HANDLING

A. Do not overload the structure with storage of materials; verify roof deck weight capacity and location of structural supports, only items needed that day shall be stored on the roof. Limit loads on roof to 25 pounds per square foot for uniformly distributed loads for metal / wood decks, 75 pounds per square foot for uniformly distributed loads for concrete decks. Store and protect products in accordance with manufacturer's instructions.

B. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact. Protect sheet metal items during transportation and handling.

C. Store products in weather-protected environment [manufacturer's plastic wrap is accepted for proper protection, unless wrap is broken, torn or removed], clear of ground 4 inches minimum and protected from exposure from direct sunlight. Use breathable tarps for moisture protection as needed. Damaged materials will be marked 'rejected' by the Contractor / Owner or Architect and removed from the site.

D. Storage of flammable liquids in buildings is prohibited. All combustible debris shall be removed from the site daily.

1.7 WEATHER CONDITIONS

A. Do not apply materials during inclement weather, high winds or when the chance of rain is 60% or greater, percentage as listed on www: weather.com for the local area, percentage as listed when read at 7 AM local time or at time of work commencement.

1.8 SEQUENCING and SCHEDULING

A. Building space underneath roof work is utilized by on-going operations. Coordinate all work with Owner including, material storage, scaffolding [as required] and contractor parking. Owner's approval required before proceeding with the work. **Contractor must provide overhead protection for owner's workers from falling materials/debris at building entry points.**

1.9 MANUFACTURERS WARRANTIES

A. Provide a manufacturer's warranty for both repairs/replacements due to any faults in the material and workmanship. Any repairs/replacement due to normal wear and tear, material finish defects and workmanship defects.
   1. Sheet metal items shall be warranted watertight for [20] twenty years by the roof membrane manufacturer.

2. Sheet metal manufacturer of record must provide a [20] twenty-year finish warranty for the metal fascia, coping and edge as outlined herein, Warranty shall cover finish fading, chalking, cracking, peeling or failure of paint to adhere to the base metal. The warranty shall be a lifetime warranty for defects of material or failure to resist wind speeds as outlined.
3. Sheet metal coping and roof edges that terminate into/attach to [incorporated] into the roof membrane shall be warranted for winds up to 120 MPH or higher by the roof membrane manufacturer [part of the roof warranty] or by the metal manufacturer. Pre-manufactured items regardless of their location must be warranted and be tested by the metal manufacturer to resist failure [blow off] for wind speeds up to *120* mph and be certified to meet or exceed the design pressure as stated herein. The installation of these items must be incompliance with the metal manufacturers installation requirements and field condition attachments guidelines and as shown. The roof manufacturer can incorporate this warranty requirement into their roof warranty if approved by their metal manufacturer/fabricator.

B. In the event of a default by the contractor, the manufacturer will provide a new contractor to fulfill the warranty obligation.

1.10 PORTABLE FIRE EXTINGUISHERS

A. Two standard listed multipurpose dry chemical fire extinguisher, NFPA 10, with 10-pound capacity, 4A-60B:C UL rating shall be provided and located near the work area. Additional fire extinguishers shall be provided for different roof levels/work sites [see general requirements]. Contractor to ensure all personnel are trained to use fire extinguishers.

1.11 DEFINITIONS

A. Shop fabricated includes items that will be formed at the fabricators shop predominately by press brake. Prefabricated or manufactured items will be plant manufactured ready for installation and wind rated in compliance with ANSI/SPRI ES-1.

PART 2 - PRODUCTS

General: All products shall be Building Code approved as applicable**.**

2.1 FABRICATION

A. Fabricate sheet metal items to comply with recommendations in SMACNA [architectural Sheet metal manual] and NRCA's [the NRCA roofing manual]. Conceal fasteners and expansion provisions where possible on exposed to view items. Provide expansion provisions as recommended where lapped or bayonet type expansion cannot be used.

2.2 FASTENERS/SPECIALTY ITEMS

General: Fasteners/Anchors: strength, type and configuration must meet the required pull test resistance for each attachment application. Fastener rate and pattern must be Factory Mutual or local code approved to meet the intent of the wind uplift rating specified.

A. The Contractor shall determine fastener lengths,
   1. Minimum embedment:
      a. Steel: 3/4-inch
      b. Concrete/concrete block: 1-1/4 inch
      c. Gypsum: 2-inch,
      d. Tectum: 2-inch
      e. Wood: 1 1/4 inch.
   2. Fastener manufacturers: ITW Buildex, IWT Red Head, OMG and Tru-Fast or equal.
   3. All fasteners shall be corrosion resistant steel in accordance with ASTM F1667 or type 304 -316 stainless.

B. Summary of fasteners and requirements are as follows, see roofing section:
   1. Metal Counterflashing and other LG metal sheets to Wood, ITW Buildex, 'tru-grip', self-piercing, # 9 – 11/64-inch diameter, corrosion resistance steel shank with EPDM washer, if applicable.
   2. Metal Counterflashing and Other LG Sheet Metal [exposed] to Masonry, ITW Red Head, 1/4-inch diameter, 'Scots Tapcon', stainless steel-hex head, HL treads, corrosion resistant steel shank, with EPDM washer.
   3. General Purpose Stainless Steel: Series 304 fasteners, with or w/out EPDM washers as required.

C. Summary of specialty items and requirements as follows:
   General: Sheet Metal Items: All metal components not incorporated into the roof system and not outlined herein or shown on the drawings shall be fabricated with *.032-inch-thick pre-finished aluminum or 24-gauge stainless steel unless otherwise noted.*
   1. Penetration Pockets: 24-gauge stainless steel, soldered together with 4-inch roof flange and 4-inch height or size required for condition, only use if another manufacturer approved detail, field flashing, or liquid flashing system will not work for the conditions.
   2. Continuous Cleats: Galvanized steel, 22 gauge.
   3. Counterflashing: 24 gauge pre-finished metal, fabricated in lengths maximum 12 feet, designed to be removable. Counter flashing to be notched and lapped at inside corners and joints.
   4. Equipment Enclosure shall be 24-gauge galvanized metal, shop or pre-manufactured with top fabricated [angled] to allow no moisture from entering the pipe areas, access to pipes required. Solder all corners, as applicable. Install spray-in foam insulation around the pipes to seal watertight.
   5. Coping, Wind-Rated [pre-manufactured/ES-1 shop fabricated]: pre-finished, 22 or 24 gauge pre-finished metal coping cap as shown, without exposed fasteners cleated on both sides, [continuous cleated or anchor clips configuration cleats] tapered style [toward roof], butt joint. Provide factory-fabricated corners and intersections. Concealed 8-inch-wide splice plates which must allow the cap to expand and contract freely while locked in place, continuous cleats or with a heavy gage metal anchor clips [12 inches wide] anchored to nailer/substrate in accordance with print approvals [maximum spacing three feet on center-two feet in corners]. Size and shape as shown or to match existing wall width, roof membrane manufacturer approved and warranted to meet or exceed design pressures/winds speeds [see manufacturer's warranties]. 20-year leak proof warranty by the roof membrane manufacturer and 20-year finish warranty by the metal manufacturer. Copings shall be ANSI/SPRI/FM 4435 ES-1-17 tested and approved for winds speeds up to *120 MPH* or higher. Pre-Manufactured by Metal Era's 'Perma-Tite tapered Coping or roof manufacturers equivalent.
   6. Drip Edge or Fascia, Wind-Rated [pre-manufactured/shop ES 1 fabricated] – face over 2 1/2 inches long: pre-finished 24 gauge pre-finished metal drip cover over extruded anchor bar, fastened to wood nailer with #10 screws, continuous cleated. Size, length, profile as shown, roof membrane manufacturer approved and warranted to meet or exceed design pressures/winds [see wind warranty] and 20-year finish warranty by the metal manufacturer. ANSI/SPRI/FM 4435 standard ES-1-17 and tested and approved for winds up to *120 MPH* or higher. Pre-Manufactured by Metal Era's, Anchor Tite System [drip or fascia] or roof manufacturer's equivalent.
   7. Drip Edge [shop fabricated-not wind rated] - face under 2 1/2 inches: Does not require a cleat and shall be fabricated with 24 gauge, pre-finished metal.
   8. Scupper Lining: 24-gauge, stainless steel, solder all corners, size and shape as required or shown. Installation [SMACNA FIG.1-30A similar-see drawing].
   9. Skirt [bib] Flashing Metal: 24-gauge stainless steel or pre-finished 24 gauge metal, minimum 4 inch wide. Use stainless steel screws for anchoring.

10. Conductor Head: 24 gauge pre-finished metal, pop riveted and sealed, [SMACNA, style FIG 1-25F], top opening size as existing with other dimensions in accordance with SMACNA sizing recommendations or as required by condition.
11. Downspouts: 24 gauge pre-finished metal, rectangular shape, smooth with flat lock seams, complete with mitered elbows / offsets as required, size 3-inch x 4-inch, unless otherwise noted, see roof plan for locations.
12. Downspout Hangers: 1 inch wide, 1/16-inch thick pre-finished metal [primed and painted] to match downspout color [SMACNA Fig 1-35A]. Install hanger at 10 foot on center maximum intervals. Coordinate placement with building lines and offsets as required.

2.3 SHEET METAL

General: Roof membrane manufacturer supplied and approved components [copings/roof edges - as required/shown] must be used, these sheet metal components must be pre-manufactured and be tested and approved in accordance with ANSI/SPRI/FM 4435/ES-1 test method standard and must be included into the roof warranty [as outlined]. Fabricated by Metal Panel System, Architectural Products, Metal Era, Pac-Clad Peterson, Una-Clad, Drexel Metals or Dimensional Metals, etc. *Some wind rated items may be shop fabricated, if pre-manufactured item is not currently available [a metal fabricator [see above] and roofing material manufacturer may allow the roofing contractor to use their metal/materials/installation methods and shop fabricate and install the items in accordance with their wind rated ANSI/SPRI/FM 4435-ES-1 standard approved tested requirements.] This will only be accepted if the contractor is an NRCA approved installer for ES-1 tested products and the item will comply/match Architect's detail [size/gauge/installation method] and an ES-1 current product certification is provided for each item. In all cases, the roof material manufacturer must approve/warrant the sheet metal items in accordance with meeting/exceeding the wind resistance requirements and finish warranties as outline herein and any other design requirements].* All other metal shall be shop fabricated in accordance with SMACNA 6th Edition or other details or pre-manufactured as shown.

A. Pre-Finished Sheet Steel [Galvalume]: ASTM A792, grade 40, class A250, 24 or 22 gauge [as noted], primed and repainted by coil coating, finished exposed to view side with a fluoropolymer Kynar 500 [PVDF] thermally cured coating and a wash coat .5 mil thick applied to the reverse side; 20-year warranty covering fade, chalking and film integrity. Colors as selected by Owner.

B. Pre-Finished Sheet Steel [Galvanized]: ASTM A755/A653, G90, 24 or 22 gauge [as noted], primed and repainted by coil coating, finished exposed to view side with a fluoropolymer Kynar 500 [PVDF] coating and a wash coat .5 mil thick applied to the reverse side; 20-year warranty covering fade, chalking and film integrity. Colors as selected by Owner.

C. Pre-Finished Aluminum: ASTM B209, 3105 H15 alloy, thickness .032, .040 or .50 inches [as noted], primed and repainted by the coil coating, finished exposed to view side with a fluoropolymer kynar 500 [PVDF] thermally cured coating and a wash coat 0.5 mil thick applied to the reverse side; 20-year warranty covering fade, chalking and film integrity. Colors as selected by the Owner.

D. Galvanized Sheet Steel: ASTM A653, hot dipped, zinc coated, G90, gauges as shown.

E. Stainless Steel: ASTM A240/A 240M, dead soft fully annealed, smooth 24-gauge, Type/Grade 304 [painted or not] and 316 [exposed to view].

2.4 SEALANTS/TAPES

General Use: Provide joint sealants for sheet metal, backing and other materials as required to seal joint that are compatible with each other based upon industry test and field experience.

A. ASTM C920, Type, Grade, Class as required to seal joints, single component, elastomeric silicone polymer, non- staining, non-shrinking, non-sagging and ultra-violet resistant, clear or to match surrounding existing color.

1. Refer to section 079201.

B. Gutter: GE Silicone II, clear in color, or approved equal.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release paper.

PART 3 - EXECUTION

3.1 EXAMINATION and CONDITIONS

A. Verify that surfaces and site conditions are ready to receive work.

3.2 PROTECTION

A. Protect building surfaces/interior spaces against damage from work.

B. Provide, erect barricades and guardrails as required by applicable regulatory advisory to protect occupants of building and workers.

3.3 INSTALLATION OF SHEET METAL AND SPECIALTY ITEMS

General: Sheet metal items shall be installed in accordance with **manufacturer's and NRCA's/SMACNA** recommendations and details from their current manual. Anchor sheet metal items securely in place with provisions for expansion. Use items as required to complete the sheet metal or drainage system. Where dissimilar metals contact each other, protect against galvanic action by coating material as recommended by the fabricator. Seal joints with sealant as required for a watertight condition.

A. Continuous cleat [for non-pre-manufactured metal components]: Cleats shall not exceed 12 feet in length; allow a 1/4 inch gap between pieces. Fasten cleat to wood nailer top as applicable at 4 inches on center [staggered pattern-1 inch from edge] with corrosion resistant annular threaded nails [3/16-inch head], long enough to penetrate the wood 1-1/4 inch.

B. Penetration pans shall have mortar installed in the bottom of pitch pans with polyurethane pourable sealer [2-inch depth minimum] filled to the top of the pan, then slope.

C. Skirt [Bib] flashing shall be installed around all roof top units/supports and all items that cannot be removed and reinstalled. Position under unit curb and anchor to unit with corrosion resistance fasteners with EPDM washers at 12 inches on center unless otherwise noted.

D. Equipment enclosure shall have mortar installed in the bottom with polyurethane pourable sealer [2-inch depth minimum] filled. Seal pipes that exit enclosure with sealant/foam.

E. Termination bars shall be placed no more than 1-1/2 inches down from the top of the base flashing and be fastened at 6 inches on center with concrete self-tapping [tapcon] or wood fasteners, as applicable, fitted with an EPDM washer. Provide sealant at the top edge of bars.

F. Counterflashing [CF] shall be surfaced mounted [SM] or in existing or new reglets/receivers with lap joints 4 inches. Attach SM with concrete self-tapping [tapcon] or wood fasteners, as applicable fitted with an EPDM washer at 12 inches on center, 1-inch minimum embedment. Apply a bead of sealant on the top of 45% angle lip of the metal flashing if SM type. CF shall overlap base flashing a minimum of three inches, fit tightly to base flashing and shall terminate no lower than 4 inch above finished roof surface, unless approved by the manufacturer.

G. Wind Rated ES-1 approved coping sections shall be jointed together with a butt type joint with 8-inch-wide concealed splice located underneath the 10 to 12-foot-long panels, which must allow to expand and contract freely while locked in place. Provide factory-fabricated corners, intersections and ends. Coping metal anchor clips to be anchored to wood nailer or surface material at splice joints and within the coping panel [approx. every three feet on center-2 feet in corners.] or coping that is installed using continuous cleats on both sides shall have cleats anchored on top of nailer at 12 inches on center. Provide self-adhered or adhered 60 mil thick

EPDM over nailers/substrate to allow moisture to drain off edges without moisture to enter wall under coping cap [provide non-curing dual sealant strips on each side of splice plates], ensure EPDM membrane covers all wood nailers/substrate. Both methods shall use stainless steel fasteners or other fasteners to meet the wind resistance pressures as shown and as recommended by coping manufacturer **printed approvals**. Coping shall have a 4-inch vertical end flange where terminating into wall, counter-flash flanges.

H. Wind Rated, ANSI/SPRI/FM 4435/ES-1 approved roof fascia/drip shall have an extruded anchor bar, face fastened as outlined per the metal manufacturer, 12 inches on center to the nailer with 2-inch-long #10 stainless steel fasteners with the roofing membrane extending under the anchor bar and down face of nailer or wall surface. Fascia/drip cover plate shall be cleated and snapped in place with no exposed fasteners. The formed roof flange/cover plate shall be set in approved sealant/mastic on finished roof surface with the written manufacturer's guidelines. Edge face shall exceed down to overlap and cover nailers onto exterior wall minimum 2 inches or existing metal fascia as shown. Follow manufacturer installation instructions.

I. Conductor heads shall be installed in accordance with Fig 1-25 F SMACNA. Set top of conductor head at 1 inch below scupper to permit overflow. Provide extended face plate around scupper opening as required to cover old profile.

J. Downspouts shall be attached to the conductor with screws. Attach downspout sections to wall with 1-inch-wide, 1/16-inch steel straps [2 per 10-foot section] - Fig 1-35 A SMACNA, with stainless steel screws anchored into solid support members. Down spouts terminating at ground or roof shall be provided with an elbow fitting and a concrete splash block [provide a roof membrane sheet under blocks that terminate on the roof]. If existing receivers are available or new undergrade piping is installed, downspouts shall be inserted into receivers, provide size and shape adapters as necessary.

K. Drip edge [face under 2-1/2 inches in length]. Anchor roof flange onto wood nailers with screws or nails driven flush at 4 inches on center, staggered. Drip edge face to extend into gutter or overlap fascia board minimum 3 inches.

3.4 CLEANING

A. In areas where finished surfaces are soiled by any other source of soiling caused by work of this section, consult manufacturer for cleaning advice.

END OF SECTION

SECTION 07 62 10 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 WORK INCLUDES

A. Installation of new sheet metal flashings and counterflashings for siding / building enclosure components, except for roof related components [Refer to Section 07 62 00].

1.2 SYSTEM DESCRIPTION

A. Sheet Metal System: Conform to criteria of [SMACNA "Architectural Sheet Metal Manual."]

1.3 SUBMITTALS

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, termination, and installation details.

1.4 COORDINATION

A. Coordinate sheet metal flashing, trim layout installation with adjoining building enclosure components such as siding, trim, openings, penetrations, etc. to provide a leakproof, secure non-corrosive installation.

1.5 PERFORMANCE REQUIREMENTS

A. Fire Hazard Classification: Underwriters Laboratories [UL], Use only Class A fire-rated materials as tested in accordance with ASTM E 108 or UL 790 for exterior fire.

B. Install sheet metal items to withstand wind loads, structural movement, by preventing buckling, opening of joints, hole elongation, failure of joint sealant, failure of connections and other detrimental effects.

1.6 DELIVERY, STORAGE and HANDLING

A. Do not overload the structure with storage of materials; verify roof deck weight capacity and location of structural supports, only items needed that day shall be stored on the roof. Limit loads on roof to 25 pounds per square foot for uniformly distributed loads for metal / wood decks, 75 pounds per square foot for uniformly distributed loads for concrete decks. Store and protect products in accordance with manufacturer’s instructions.

B. Deliver products in manufacturer’s original containers, dry, undamaged, with seals and labels intact. Protect sheet metal items during transportation and handling.

C. Store products in weather-protected environment [manufacturer’s plastic wrap is accepted for proper protection, unless wrap is broken, torn or removed], clear of ground 4 inches minimum and protected from exposure from direct sunlight. Use breathable tarps for moisture protection as needed. Damaged materials will be marked ‘rejected’ by the Contractor / Owner or Architect and removed from the site.

D. Storage of flammable liquids in buildings is prohibited. All combustible debris shall be removed from the site daily.

1.7 SEQUENCING and SCHEDULING

A. Building space underneath roof work is utilized by on-going operations. Coordinate all work with Owner including, material storage, scaffolding [as required] and contractor parking. Owner’s approval required before proceeding with the work. **Contractor must provide overhead protection for owner’s workers from falling materials/debris at building entry points.**

1.8 DEFINITIONS

A. Shop fabricated includes items that will be formed at the fabricators shop predominately by press brake.

1.9 WARRANTY

A. Furnish lifetime limited year manufacturer warranty for finishes.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

A. Pre-Finished Aluminum Sheet: ASTM B209; 3003 alloy, H15 alloy; mill finish shop pre-coated with acrylic color as selected from full range of manufacturer's standard colors.
   1. 20 gauge [0.032 inch thick] cladding / flashings where intended to be left exposed [including all fascia and rake, trim cladding, etc]. Alternate: install 24 gauge pre-finished metal cladding where needed / outlined on drawings. Coordinate with Section 07 62 00.
   2. 24 gauge [0.020 inch thick] or 26 gauge [0.016 inch thick] flashings at starter strips, concealed flashings, etc.

B. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M; grade A; structural steel sheet, G90 (Z275) zinc coating; 24 gauge steel, shop pre-coated with two coat fluoropolymer top coat [Kynar 500, 70% formulation]; color as selected from full range of manufacturer's standard colors.

2.2 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers as required to suit conditions.

B. Underlayment: ASTM D226; Type I, No. 15 unperforated asphalt felt.

C. Protective Backing Paint: Bituminous.

D. Slip Sheet: Rosin sized building paper.

E. Sealant: Exterior metal lap joint butyl or polyisobutylene sealant as specified in Section 07 90 00.

F. Plastic Cement: ASTM D4586, Type I.

G. Reglets: As required to suit conditions.

H. Primer and Solvent for Polyvinyl Chloride (PVC): As recommended by manufacturer.

2.3 FABRICATION

A. Fabricate sheet metal items to comply with recommendations in SMACNA [architectural Sheet metal manual], NRCA’s [the NRCA roofing manual], and siding manufacturer details. Conceal fasteners and expansion provisions where possible on exposed to view items. Provide expansion provisions as recommended where lapped or bayonet type expansion cannot be used.

B. Form components to shape indicated on Drawings, accurate in size, square, and free from distortion or defects. Form pieces in longest practical lengths.

C. Fabricate cleats and starter strips of same material as sheet, to interlock with sheet.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

E. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.

F. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

G. Fabricate corners in one piece, 18 inch long legs; seam for rigidity, seal with sealant.

2.4 SHOP FINISHING

A. Acrylic coating: Baked enamel system conforming to AAMA 2603.

B. PVDF (polyvinylidene fluoride) coating: Multiple coats, thermally cured, fluoropolymer system conforming to AAMA 2604 or AAMA 2605. (KYNAR 500)

C. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. Install starter and edge strips, and cleats.

B. Install surface mounted reglets. Seal top of reglets with sealant. Insert flashings to form tight fit. Seal flashings into reglets with sealant.

C. Secure flashings in place using [concealed] fasteners.

D. Install cladding over existing / new wood substrate. Brake form to profiles required in the longest lengths practical. Hang to minimize oil canning and other unintended movement / twisting, etc. Allow for expansion and contraction.

E. Apply plastic cement compound between metal work and felt flashings.

F. Fit components tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Seal joints watertight.

END OF SECTION

SECTION 07 76 10 – RUBBER PAVING TILES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes resilient, interlocking, architectural rubber paving tiles.

1.2 SUBMITTALS

A. Product Data: Submit data indicating materials, component profiles, jointing details, sizes, surface texture, finishes / colors, and accessories.

B. Samples: Submit two samples illustrating surface texture and color.

1.3 REFERENCES

A. ASTM C 67 – Standard Test Method Methods for Sampling and Testing Brick and Structural Clay Tile.

B. ASTM D 395 – Standard Test Methods for Rubber Property–Compression Set.

C. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers–Tension.

D. ASTM D 573 – Standard Test Method for Rubber-Deterioration in an Air Oven.

E. ASTM D 624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

F. ASTM D 1667 – Standard Specification for Flexible Cellular Materials, Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).

G. ASTM D 2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.

H. ASTM D 2859 – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

I. ASTM E 108 – Standard Test Methods for Fire Tests of Roof Coverings.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of 5 years experience for the manufacturing of rubber paving tiles similar to those specified.

B. Installer Qualifications: Minimum of 3 years' experience with installation of similar products.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Remodel mock-up area as required to produce acceptable work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation in accordance with manufacturer's instructions.

B. Handle products to prevent damage.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Tile Temperature: Ensure surface temperature of rubber paving tiles is a minimum of 40 degrees F at the time of installation.

B. Air Temperature: Ensure ambient air temperature is a minimum of 40 degrees F for a minimum of 24 hours prior to and at the time of installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Limited lifetime product warranty against manufacturing defects, non pro-rated

PART 2 PRODUCTS

2.1 RUBBER PAVING TILES

A. Description: Resilient, interlocking, architectural rubber paving and ballast tiles.
   1. Basis of Design: DuraSTRONG Rubber Paving Tiles, Plus Series, or Equal.

B. Material: Compression-molded, recycled rubber and binding agents.

C. Tile Locking: U-shaped male and female locking mechanism on all 4 sides of the tile to support tile-to-tile adhesion while ensuring tiles are held in place.

D. Top Edges: Chamfered.

E. Tile Sides: edge-cut system for maximum seam adhesion.

F. Wear Layer: compression molded to obtain optimum density and durability. Combination of elongated SBR rubber and granulated crumb rubber. Pigmented to achieve color.

G. Size: 24” x 24” nominal size.

H. Thickness: 2-inches.

I. Weight: 24 pounds.

J. Color: As selected from the full range of available colors.

K. Testing
   1. Freeze Thaw, ASTM C 67: No deterioration.
   2. Rubber Deterioration/Air Oven, ASTM D 573: No deterioration.
   3. Slip Resistance:
      a. ASTM E 303: Dry: 51 minimum; Wet: 44 minimum.
      b. ASTM D 2047: 0.533.
   4. Tensile Strength, ASTM D 412: 0.661 Mpa
   5. Elongation at Break, ASTM D 412: 68.5 percent
   6. Tear Strength, ASTM D 624: 2.2 kNm
   7. Flammability, Burning Pill, ASTM D 2859 – Pass
   8. Density, ASTM D 3676: 817 kg/m3
   9. Taber Abrasion, Wear Index, ASTM C 501: 205.

2.2 ACCESSORIES

A. Corners:
   1. Prefabricated outside and inside corners.
   2. Material: Same as rubber paving tiles.

B. Adhesive:
   1. Approved and furnished by manufacturer.
   2. Single-component, 100% solids, polyurethane.
   3. Waterproof and supplied in tube format.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive rubber paving tiles. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 PREPARATION

A. Prepare subsurface in accordance with manufacturer's instructions to ensure proper slope, support and drainage for rubber paving tiles.

B. Ensure existing sub-surface is clean and sound with no cracks or loose material.

C. Do not damage EPDM roof membrane during installation.

3.3 INSTALLATION

A. Install rubber paving tiles in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Apply adhesive in accordance with manufacturer’s instructions for tile-to-tile installation.

C. Cut rubber paving tiles to fit around fixed obstacles.

D. Install additional rubber paving tiles securement at perimeter in accordance with manufacturer’s instructions.

3.4 CLEANING

A. Remove adhesive spills from rubber paving tiles in accordance with manufacturer's instructions.

B. Clean rubber paving tiles in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect completed tiles from damage during construction.

B. Protect rubber paving tiles from foot traffic for a minimum of 12 hours after installation.

END OF SECTION

SECTION 07 90 00 - JOINT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sealants and joint backing.

1.2 SUBMITTALS

A. Product Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.4 QUALITY ASSURANCE

A. Sealant shall be installed by a qualified sealant applicator for any/all joint sealant exposed to view. Owner reserves the right to request a mockup of the quality for the joint sealant installation.

PART 2 PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
   1. Tremco [basis of design]
   2. Sika
   3. GE Silicones.
   4. Pecora Corp.
   5. DAP

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Liquid-Applied Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

E. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Additional Movement Capability: Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range, unless otherwise noted.

2.2 SILICONE JOINT SEALANTS:

A. **Type S-1**: Single component, nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, Use NT

1. Tremco Spectrem 1 or Spectrem 800 or Equal

B. **Type S-2**: Single Component, nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, use NT
   1. Tremco Spectrem 2 or Spectrem 3 or Equal

C. **Type S-3**: Multi-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, Use NT
   1. Tremco Spectrem 4-TS or Equal

D. **Type S-4**: Single Component, nonsag, Traffic-Grade, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, Use T
   1. Tremco Spectrem 800 or Equal

E. **Type S-5**: Mildew Resistant, Single Component, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT
   1. Tremco Tremsil 200 Sanitary or Equal

2.3 URETHANE JOINT SEALANTS

A. **Type U-1**: Single Component, nonsag, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25 or 35, Use NT:
   1. Tremco Dymonic or Dymonic FC or Equal

B. **Type U-2**: Single Component, nonsag, Traffic Grade, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use T.
   1. Tremco Vulkem 116 or Equal.

C. **Type U-3**: Multi-Component, nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, Use T.
   1. Tremco Dymeric 240 or Dymeric 240 FC or Equal

D. **Type U-4**: Multi-Component, nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, Use NT.
   1. Tremco Vulken 227 or Equal

E. **Type U-5**: Multi-Component, nonsag, Traffic Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, Use T.
   1. Tremco Vulken 227 or Equal

2.4 BUTYL JOINT SEALANTS

A. **Type B-1**: Butyl Rubber based Joint Sealants: ASTM C 1311
   1. Tremco General Purpose Butyl Sealant or Equal

2.5 LATEX JOINT SEALANTS

A. **Type L-1**: Latex Joint Sealant: Acrylic latex or Siliconized Acrylic Latex: ASTM C834, Type OP, Grade NF or better
   1. Tremco Tremflex 834 or Equal.

B. **Type L-2**: Paintable Mildew-Resistant Latex Joint Sealant: Acrylic Latex or Siliconized Acrylic Latex: ASTM C834, Type OP, Grade NF or better.
   1. Tremco Tremflex 834 or Equal.

2.6 ACCESSORIES

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and

density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Oversized to 30 to 50 percent larger than joint width.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

E. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated. Non-staining type, recommended by sealant manufacturer to suit application.

F. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

G. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate surfaces and joint openings are ready to receive work.

B. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

3.4 SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and non-traffic horizontal surfaces.
1. Joint locations such as, but not limited to:
    a. Construction joints in cast-in-place concrete.
    b. Control joints in unit masonry.
        1) Provide joint sealants slightly darker than the adjacent masonry units. Provide multiple colors as may be required for match.

c. Perimeter joints between masonry, concrete, or stone and frames of doors, windows, storefronts, louvers, and similar openings.
d. Lintels and shelf angles to masonry construction.
e. Butt joints between metal panels.
f. Control and expansion joints in ceiling/soffit and similar overhead surfaces.
g. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by various methods of construction to make building watertight.
h. Other joints as indicated on Drawings.

2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type S-1, Type S-2, Type S-3**
3. Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint locations such as, but not limited to:
a. Isolation joints in cast-in-place concrete slabs.
b. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.
c. Areas around all piping systems that penetrate the slab or foundation walls below grade (utility trenches, electrical conduits, plumbing penetrations, etc.).
d. Control and expansion joints in tile flooring.
e. Other joints as indicated on Drawings.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type S-4**
3. Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces, subject to movement, unless otherwise noted.
1. Joint locations such as, but not limited to:
a. Control joints on exposed interior surfaces of exterior walls.
b. Interior joints where interior partitions meet exterior walls of dissimilar materials and components.
c. Other joints as indicated on Drawings.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type U-1**
3. Color: As selected by Architect from manufacturer's full range of colors. Paintable Sealant, prep for painted finish.

D. Joint-Sealant Application: Interior joints in vertical surfaces subject to abuse and movement.
1. Joint locations such as, but not limited to:
a. Vertical joints, including control joints and joints between masonry and structural support members, on exposed surfaces of interior unit masonry walls and partitions.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type U-2**
3. Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces not subject to movement.
1. Joint locations such as, but not limited to:
a. Interior perimeter joints of exterior openings.
b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
c. Interior joints between dissimilar materials where a gap is created where materials meet, unless otherwise noted.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type L-1, Type L-2**
3. Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in non-painted vertical surfaces and horizontal nontraffic surfaces.
   1. Joint locations such as, but not limited to:
      a. Interior joints between plumbing fixtures and adjoining floors and counters.
      b. Joints between countertops and backsplashes.
      c. For interior joints in non-painted vertical and horizontal surfaces where incidental food contact may occur.
      d. Tile control and expansion joints where indicated.
      e. Other joints as indicated on Drawings.
   2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type S-5**
      a. For potable water storage sealant shall be certified by National Sanitation Foundation as conforming to the requirements of NSF Standard 61 – Drinking Water System Components – Health Effect.
      b. For surfaces where incidental food contact may occur sealant must comply with United States Department of Agriculture (USDA) guidelines for incidental food contact with cured sealant.
   3. Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Mildew-resistant interior joints in painted vertical surfaces and horizontal non-traffic surfaces.
   1. Joint locations such as, but not limited to:
      a. Interior joints between plumbing fixtures and adjoining painted walls.
      b. Joints where countertops or backsplashes intersect painted walls.
      c. For interior joints in painted vertical and horizontal surfaces where incidental food contact may occur.
   2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type L-2**
   3. Color: As selected by Architect from manufacturer's full range of colors.

H. Joint-Sealant Application: Interior or exterior joints in vertical surfaces between laps in fabrications of sheet metal.
   1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type U-1**
   2. Color: As selected by Architect from manufacturer's full range of colors.

I. Joint-Sealant Application: Exterior joints under metal thresholds and saddles, sill plates, or as bedding sealant for sheet metal flashing and frames of metal or wood.
   1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type S-1, Type U-1, Type B-1**
   2. Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 08 11 15 - PRE-ASSEMBLED METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pre-assembled steel entry doors in wood / composite frames.

1.2 SUBMITTALS

A. Product Data: Submit frame and door configurations, core materials, finishes, fire ratings, and Energy Star Compliance.

1.3 QUALITY ASSURANCE

A. Perform glazing Work in accordance with the following:
   1. Insulated Glass: Fabricate insulated glass units in accordance with GANA (formerly FGMA) Glazing Manual.
   2. Safety Glass: Conform to CPSC 16 CFR 1201 and applicable codes.

B. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

D. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
   1. Installer shall be certified by Manufacturer.

1.4 WARRANTY

A. Furnish five year manufacturer’s warranty on workmanship and materials.

B. Furnish five year manufacturer’s warranty for insulated glass units from seal failure, interpane dusting or misting, including replacement.

PART 2 PRODUCTS

2.1 PRE-ASSEMBLED STEEL DOORS AND FRAMES

A. Manufacturers:
   1. Masonite: High Definition Steel Entry Doors.
   2. Therma-Tru: Profiles Steel Entry Doors, Equal to Above Style.
   3. Jeldwen: Premium Steel Exterior Door, Equal to Above Style.
   4. Lansing Housing Products

2.2 ENTRY DOORS

A. Construction: Tension-leveled cold rolled steel, zinc-coated, conversion coated to permit paint bond skins:
   1. Thickness: 1-3/4 inch thick; 24 gauge steel sheet face, 0.021 inch minimum.
   2. Door surface: smooth, flush style with glazed openings, design as indicated on Drawings
   3. Door Core Construction: Thermally Broken, wood stiles and rails, with foamed in place insulation.
   4. Door Edges: Machinable kiln-dried pine or engineered composite lumber mechanically locked to door faces, four sided full thermal break provided, lock area reinforced with solid blocking in full area of passage and deadbolt locksets.
   5. Door Bottom Edge: Moisture- and decay-resistant composite.

6. Door Bottom Edge Weatherstripping: Bottom Sweep compatible with accessible threshold; provide corner seal pads as required to seal bottom of door at frame.
7. Core: Foamed-in-place polyurethane, density 1.9 pcf minimum.
8. Finish: White primed. [ready for field paint]
9. Glazing Style: Clear, Full lite insulated glazing.
10. Door Configuration: Frame hinge, inswing patio door – sized to fit existing rough opening / door being removed, left and right hand configurations to match existing.
11. Energy Efficiency: Maximum U-Value of 0.30.

2.3 DOOR FRAMES

A. Composite Frames: Rot-resistant door frame, mullions, and brickmold, as supplied by Door manufacturer. Formed with integral stop for weatherstripping; accessible style threshold.
   1. Jamb Width: +/- 6-9/16 inch; Match existing wall thickness, field verified by Contractor.
   2. Mullion: Storm door ready Mullion [& Adaptor as required]; nominal 2 inch width
   3. Trim: Composite 2” brickmold
   4. Sill: High Dam type unless located in accessible unit
   5. Hinges: Steel, full mortise butt hinges; 4 x 4 inches, finish to match door hardware specified in Section 08 71 00.
   6. Finish: Painted

2.4 COMPONENTS

A. Steel Sheet: Galvanized to ASTM A653/A653M G60 coating class.

B. Insulation: Polyurethane.

C. Insulating Glass: Sealed double pane units with Low E coating with internal grid. Max U-Value of 0.30.
   1. Outer Pane: Clear fully tempered safety glass, Low-E Coating.
   2. Inner Pane: Clear fully tempered safety glass.
   3. Pane Thickness: Minimum 1/8 inch thick.
   4. Minimum Total Unit Thickness: 5/8 inch minimum.
   5. Internal Decorative Pattern: as indicated on Drawings.

2.5 HARDWARE

A. Weatherstripping: Jacketed, thermoset open-cell foam, press-fit in kerfs at jamb stops in frames. Medium Reach Compression type; Bottom sweep compatible with accessible threshold.
   1. Note: insulation shall be installed to fully prevent passage of light and air thru any gaps in the frame and door leaf.

B. Hardware Finish: US 26D [unless directed Otherwise by Owner]

C. Remainder of Hardware: Specified in Section 08 71 00.

2.6 ACCESSORIES

A. Door Casings:
   1. Exterior: 2 inch brickmold or 1x trim
   2. Interior: wood casing.

B. Bituminous Coating: Non-asbestos fibered asphalt emulsion.

C. Primer: Manufacturer's standard rust inhibitive type.

2.7 FABRICATION

A. Fabricate doors and frames as pre-hung single piece jamb units with continuous threshold for each opening.

B. Fabricate pre-hung units with hardware reinforcement welded in place.

C. Configure exterior frames to accept weatherstripping.

D. Factory glaze doors.

E. Attach fire rating label to each fire rated door and frame.

2.8 FACTORY FINISHING

A. Doors and Frames:
   1. Primer: Baked on dry powder.
   2. Finish Coating: Field Applied.

B. Hardware Finish:
   1. Steel Components: Satin chrome finish or with finishes to match door hardware as applicable.
   2. Aluminum Components: Mill finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify framed openings are correct size and thickness and project conditions are acceptable.

3.2 INSTALLATION

A. Install units in accordance with manufacturers installation instructions.

B. Install fire rated assemblies in accordance with NFPA 80.

C. Install doors and frames plumb, level and square.

D. Coordinate installation of hardware specified in Section 08 71 00.

E. Field Finishing: As specified in Section 09 90 00.

F. Adjust door and frame units to ensure smooth and balanced movement.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.4 SCHEDULES

A. Exterior Entry Doors: Steel door with wood / composite frame; sized per drawings, style as indicated on drawings; with continuous threshold. Hardware per section 08 71 00.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hardware exterior patio doors being replaced as part of this project.
   1. Provide cylinders and keys for all doors.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedule, and catalog cuts.
   2. Submit manufacturer's parts list, and templates.

B. Manufacturer's installation instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of installed cylinders and their master key code.

B. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

C. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:
   1. ANSI A156 series.
   2. NFPA 80 - Fire Doors and Windows.
   3. NFPA 101 - Life Safety Code.

B. Furnish hardware marked and listed in BHMA Directory of Certified Products.

C. Coordinate work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
   1. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.

D. Coordinate Owner's keying requirements during course of work.

1.5 WARRANTY

A. Furnish five year manufacturer warranty for door hardware.

1.6 MAINTENANCE SERVICE

A. Provide special wrenches and tools applicable to each different or special hardware component.

PART 2 PRODUCTS

2.1 DOOR HARDWARE

A. Lockset, Latch Set, and Cylinder Manufacturers:
   1. KwikSet Delta Lever Latchset [match building standard]

B. Deadlock Manufactures:
   1. KwikSet SmartKey – Key Control Deadbolt [match building standard].

C. Cylinders: Match CMHA standards, field verify all requirements.

2.2 COMPONENTS

A. General Hardware Requirements: Where not specifically indicated, comply with applicable ANSI A156 standard for type of hardware required. Furnish each type of hardware with accessories as required for applications indicated and for complete, finished, operational doors.
   1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently in advance to avoid delay in Work.
   2. Reinforcing Units: Furnished by door and frame manufacturers; coordinated by hardware supplier or hardware manufacturer.
   3. Fasteners: Furnish as recommended by hardware manufacturer and as required to secure hardware.
      a. Finish: Match hardware item being fastened.

B. Hinges: ANSI A156.1, full mortise type, template type, ANSI A156.7, complying with following general requirements unless otherwise scheduled.
   1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
   2. Number: Furnish minimum three hinges to 90 inches high, four hinges to 120 inches high for each door leaf.
   3. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior doors, non rising pins at interior doors.
   4. Tips: Flat button tips with matching plug.

C. Locksets: Furnish locksets compatible with specified cylinders. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt verify type of cutouts provided in metal frames.
   1. Bored (Cylindrical) Locksets: ANSI A156.2, Grade 3 unless otherwise indicated.

D. Latch Sets: Match locksets. Typical 2-3/4” backset. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt.
   1. Bored (Cylindrical) Latchsets: ANSI A156.2, Grade 3 unless otherwise indicated.

E. Push/Pulls, Gaskets, Thresholds, and Trim: Furnish as indicated in Schedule, with accessories as required for complete operational door installations.
   1. Weatherstripping: Furnish continuous weatherstripping at top and sides of exterior doors.
   2. Thresholds: Standard high dam type at non accessible dwelling units.

F. Cylinders: Match Owner Standard.

G. Keying: Keyed as directed by Owner to integrate with existing Keying Schedule.
   1. Keys: Nickel silver. Stamp keys with “DO NOT DUPLICATE”.
   2. Supply keys in the following minimum quantities
      a. 3 keys per residential unit.

2.3 ACCESSORIES

A. Lock Trim: Furnish levers with 2 3/8” rose.

B. Through Bolts: Through bolts and grommet nuts are not permitted on door faces in occupied areas unless no alternative is possible.
   1. Do not permit through bolts on solid wood core doors.

2.4 FINISHING

A. Finishes: ANSI A156.18; with following finishes except where otherwise indicated in Schedule at end of section.
   1. Hinges: Satin nickel.
   2. Exterior Door Hardware: Satin nickel

3. Thresholds: Finish appearance to match door hardware on exterior face of door.
4. Other Items: Provide manufacturer's standard finishes matching similar hardware types on same door, and maintaining acceptable finish considering anticipated use and BHMA category of finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify doors and frames are ready to receive work and dimensions are as indicated on shop drawings and as instructed by manufacturer.

3.2 INSTALLATION

A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.

B. Mounting Heights from Finished Floor to Center Line of Hardware Item: Comply with manufacturer recommendations and applicable codes.
1. Locksets: 38 inches
2. Dead Bolt: 48 inches
3. Top Hinge: Jamb manufacturer's standard, but not greater than 10 inches from head of frame to centerline of hinge.
4. Bottom Hinge: Jamb manufacturer's standard, but not greater than 12-1/2" from floor to centerline of hinge.
5. Intermediate Hinges: Equally spaced between top and bottom hinges and from each other.

3.3 ADJUSTING

A. Adjust hardware for smooth operation.

3.4 SCHEDULE

A. The following hardware sets are intended to establish type and standard of quality when used together with these section requirements. Examine Drawings and Specifications and furnish proper hardware for door openings.

1. Each new door requires two (2) of the Rockwood 528 stop. Also provide wall mounted plastic door stop plate at any door adjacent to a gypsum wall.

Hardware Set H-1: Patio Entry Doors

Hinges:	1-1/2 pair, 4x4 butt hinges
Stops:	Rockwood 528, plastic wall plate
Lock Set:	ANSI function F75 [passage latchset]
Dead Bolt	ANSI function E0152 [deadbolt with interior thumbturn]
Weatherstripping	Compression type
Threshold	Standard, high dam threshold

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of paints and other coatings.

B. Paint/Stain all exposed surfaces, new and existing, unless otherwise indicated.
   1. Exterior Work:
      a. Fiber Cement Siding and Trim
      b. Wood and Composite Trim
      c. Exterior Doors and Frames.
      d. Miscellaneous exterior trim.
      e. Steel Lintels

C. Do not paint prefinished items, finished metal surfaces, operating parts, labels, and materials obviously intended to be left exposed such as brick and tile.

D. Unless otherwise indicated do not paint concealed surfaces.

E. Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats. Primer and finish coat shall be factory applied, finish coat shall be field applied.

F. **Extra Materials**: Deliver to Owner **any extra materials**, properly labeled, factory sealed, of each color and type of finish coat paint used on project for each building in contract.

G. Minimum surface temperature of 50 degrees required for all coating systems.

H. Store all materials in tightly closed containers when not in use, away from heat, electrical equipment, sparks and open flames. Use approved bonding and grounding procedures. Keep out of the reach of children and residents.

I. Transfer materials to approved containers with complete and appropriate labeling.

1.2 APPLICATORS QUALIFICATIONS

A. Engage an experienced applicator with a minimum of <u>five</u> years experience and who has completed painting systems application similar in materials and extend to those indicated for the Project and that have resulted in a construction record of successful in-service performance.

1.3 SUBMITTALS

A. Product Data and Color Samples: Provide product data on each coating system component indicating VOC and environmental requirements. Coordinate coating systems for each material/substrate.

1.4 REFERENCES AND REGULATIONS:

A. Standards: Comply with applicable provisions and recommendations of the following, except when otherwise shown or specified:
   1. OSHA Safety Standards for the Construction Industry, Title 29 - Labor, Subtitle B – Regulations Relating to Labor, Occupational Safety and Health Administration (OSHA) 1926, 07/01/93 editions.
   2. OSHA Worker Safety and Health Act Regulation 29 CFR No. Parts 1900 through 1910.1400, 07/01/93 and later editions.
   3. SSPC Volume 1, Good Painting Practice, 1989 edition.
   4. SSPC Volume 2, Systems and Specifications, 1991 edition, Surface Preparation Guide and Paint Application Specifications of the Steel Structures Painting Council.

5. NACE Standards, Volume I and II, 1992 editions of the National Association of Corrosion Engineers.
6. SSPC and NACE Painter Safety Guidelines, latest editions.

B. Requirements of Regulatory Agencies, conform with the following:
1. Clean Air Act (CAA) – hazardous Air Emissions by U.S. EPA or State Agency under Regulation 40 CFR 61 or state equivalent.
2. Clean Water Act (CWA) – hazardous Water Releases by U.S. EPA or State Agency under Regulation 40 CFR 116 through 117 or state equivalent.
3. Toxic Substances Control Act (TSCA) – Toxic substance by U.S. EPA under Regulation 40 CFR 761.
4. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or "SuperFund") – Uncontrolled Hazardous Waste Sites and Hazardous Substance Release by U.S. EPA under Regulation 40 CFR 302.
5. Resource Conservation and Recovery Act (RCRA) – Generation, Transportation, Treatment, Storage and Disposal of hazardous waste by U.S. EPA or State Agency under Regulation 40 CFR 260 through 267 or state equivalent.
6. Hazardous and Solid Waste Amendments (HSWA) – Further regulation of hazardous waste by U.S. EPA or State Agency under Regulation 40 CFR through 267 or state equivalent.
7. Hazardous Material Transportation Act (HMTA) – Transportation of Hazardous Material by DOT or State Agency under Regulation 49 CFR 171 through 179 or state equivalent.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit maintenance and cleaning instructions.

1.6 QUALITY ASSURANCE

A. Surface Burning Characteristics:
1. Fire Retardant Finishes: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Store and apply materials in environmental conditions required by manufacturer's instructions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information:
1. Product name and type (description)
2. Application & use instructions
3. Surface preparation
4. VOC content
5. Environmental handling and an SDS
6. Batch date
7. Color number

B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

C. Handling: Maintain a clean, dry storage area to prevent contamination or damage to the coatings.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

1.10 MOCKUP

A. Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections and demonstrate aesthetic effects and set quality standards for materials and execution.

PART 2 PRODUCTS

2.1 PAINT AND COATINGS

A. Manufacturer
   1. Sherwin-Williams (SW) – Basis of Design
   2. PPG Porter
   3. Benjamin Moore

B. Paints and Coatings - General:
   1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such a procedure is specifically described in manufacturer's product instructions. VOCs need to be confirmed by using the products EDS sheets.

C. Primers:
   1. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

D. Coating Application Accessories:
   1. Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required per manufacturer’s specifications.

E. Colors: As selected from a full range of manufacturer’s offerings, including premium colors.

F. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.
   1. Lead: Measurable lead content in either the pigment or binder will not be permitted.
   2. The finish coats shall match colors selected.

G. Finish Quality:
   1. Finishes shall exhibit a high quality, commercial grade appearance of uniform thickness.
   2. Finishes shall be free of runs, sags, drips, waves, orange peel, festoons, dry spray, cloudiness, spotting, ropiness, brush marks, roller marks, fish eyes or other surface imperfections, voids, discontinuities, pinholes, holidays and overspray.
   3. Final coat shall be uniform in texture, color and gloss, and shall provide an acceptable match with the approved drawdown sample sheet.

H. Provide for a <u>minimum</u> of the following:
   1. Exterior Finishes: 4 colors [allow for different colors at different buildings]

2.2 EXTERIOR PAINT APPLICATION SCHEDULE

General: All coatings shall be applied according to manufacturer's application instructions, including application rates for wet film and dry film thickness.

A. Exterior Fiber Cement Siding, Trim, Composite Trim, etc: [Satin Finish]
   1. 1st Coat: S-W Exterior Latex Wood Primer, B42W8141; or S-W Exterior Oil-Based Wood Primer [refer to S-W], not required for pre-primed materials.

2. 2nd Coat: S-W Duration Exterior Acrylic Latex Satin, K33-Series
3. 3rd Coat: S-W Duration Exterior Acrylic Latex Satin, K33-Series

B. Metals - Ferrous: [Semi-Gloss Finish]
1. 1st Coat: S-W Pro-Industrial Pro-Cryl Primer [as required to suit conditions]
2. 2nd Coat: S-W Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-1150/2150 Series
3. 3rd Coat: S-W Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-1150/2150 Series

C. Metals – Aluminum / Galvanized: [Semi-Gloss Finish]
1. 1st Coat: S-W Pro Industrial DTM Acrylic Primer / Finish, B66 Series
2. 2nd Coat: S-W Pro Industrial DTM Acrylic Enamel Semi-Gloss, B66 Series
3. 3rd Coat: S-W Pro Industrial DTM Acrylic Enamel Semi-Gloss, B66 Series

D. Exterior Doors and Frames [Semi-Gloss Finish]
1. 1st Coat: S-W Pro-Industrial Pro-Cryl Primer [as required to suit conditions]
2. 2nd Coat: S-W Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-1150/2150 Series
3. 3rd Coat: S-W Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-1150/2150 Series

E. Miscellaneous metals and steel lintels:
1. 1st Coat: S-W DTM Acrylic Primer/Finish.
2. 2nd Coat: S-W SW DTM Acrylic Semi-Gloss Enamel Semi-Gloss, Acrylic Coating.
3. 3rd Coat: S-W SW DTM Acrylic Semi-Gloss Enamel Semi-Gloss, Acrylic Coating.

2.3 PRE-CLEANING AND SURFACE PREPARATION PRODUCTS

A. Pre-cleaning Agents
1. SW No Rinse Prepaint Cleaner
2. Krud Kutter
3. Potable water

B. Pre-cleaning (Power Wash) Equipment
1. Capacity to continuously deliver 3-5 gpm at 2,500 psig of 180-200 degree F hot water.
2. Cleaning system shall affect the 32-ounce per gallon dilution.
3. Manufacturer: Alkota, Model 565T with model 520 water heater or approved equal.
4. Power wash with 15 degree tip capable of delivering hot water at 2500 psig.

C. Power Tool Surface Preparation Media:
1. Scotch Brite No. 07451 by 3 M Corporation, Surface Conditioning disc.
   a. Properties
   b. Texture: A Medium
   c. Maximum Speed: 18,000 RPM
2. Clean ‘N" Strip Disco No CSD2 by 3 M Corporation
   a. Texture: Course
   b. Maximum Speed: 8,000 RPM
   c. Or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of coatings until substrates have been properly examined and prepared. Notify Architect of unsatisfactory conditions before proceeding.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Proceed with work only after conditions have been corrected, and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

D. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

3.2 SURFACE PREPARATION

A. Comply with paint manufacturer's written instructions for surface preparation, environmental and substrate conditions, product mixing, and application.

B. Perform all surface preparation in accordance with SSPC specifications, guidelines and good painting practices.

C. Proper product selection, surface preparation, and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to the substrate and prolongs the service life of the coating system.

D. Selection of the proper method of surface preparation depends on the substrate, the environment, and the expected service life of the coating system. Economics, surface contamination, and the effect on the substrate will also influence the selection of surface preparation methods.

E. The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

F. Prior to attempting to remove mildew, it is always recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions may be advised.

G. Mildew may be removed before painting by washing with a solution of 1 part liquid bleach and 3 parts water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with water and allow the surface to dry before painting. Wear protective eyewear, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

H. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50°F, unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50°F or higher to use low temperature products.

I. Methods:
   1. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
   2. Block (Cinder and Concrete): Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75°F unless the manufacturer’s products are designed for application prior to the 30-day period. The pH of the surface should be between 6 and 9 unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.
   3. Concrete, SSPC-SP13 or NACE 6: This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.
   4. Cement Composition Siding/Panels: Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked

paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.

5. Drywall—Exterior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting. Exterior surfaces must be spackled with exterior grade compounds.
6. Exterior Composition Board (Hardboard): Some composition boards may exude a waxy material that must be removed with a solvent prior to coating. Whether factory primed or unprimed, exterior composition board siding (hardboard) must be cleaned thoroughly and primed with an alkyd primer.
7. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.
8. Steel: Structural, Plate, etc.: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
9. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
10. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before Hand Tool Cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
11. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before Power Tool Cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
12. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
13. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
14. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.
15. Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals, SSPC-SP16: This standard covers the requirements for brush-

off blast cleaning of uncoated or coated metal surfaces other than carbon steel by the use of abrasives. These requirements include visual verification of the end condition of the surface and materials and procedures necessary to achieve and verify the end condition. A brush-off blast cleaned non-ferrous metal surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, metal oxides (corrosion products), and other foreign matter. Intact, tightly adherent coating is permitted to remain. A coating is considered tightly adherent if it cannot be removed by lifting with a dull putty knife.

16. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
17. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
18. Water Blasting, NACE Standard RP-01-72: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.
19. Stucco: Must be clean and free of any loose stucco. If recommended procedures for applying stucco are followed, and normal drying conditions prevail, the surface may be painted in 30 days. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments such as Loxon.
20. Wood—Exterior: Must be clean and dry. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.
21. Vinyl Siding, Architectural Plastics & Fiberglass or other PVC, plastic building products. Clean the surface thoroughly by scrubbing with warm, soapy water. Rinse thoroughly, prime with appropriate white primer. Do not paint vinyl with any color darker than the original color. Do not paint vinyl with a color having a Light Reflective Value (LRV) of less than 56 unless VinylSafe® Colors are used. If VinylSafe® Colors are not used and darker colors lower than an LRV of 56 are, the vinyl may warp. Follow all painting guidelines of the vinyl manufacturer when painting. Only paint properly installed vinyl siding. Deviating from the manufacturer's painting guidelines may cause the warranty to be voided.

3.3 APPLICATION

A. Examination and Verification of Condition: Contractor shall verify the areas and conditions under which the work is to be performed and notify the Owner in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until satisfactory conditions have been corrected. Do not coat over chalk, dirt, scale, moisture, oil, surface contaminants, coatings that have exceeded the manufacturer’s re-coat guidelines, or conditions otherwise detrimental to the formation of a durable high quality coating system.

B. Comply with manufacturer’s instructions and SSPC Good Paint Practices Volumes 1 and 2.

C. Comply with OSHA regulations, State of Ohio and Federal laws, ordinances, and guidelines.

D. Follow manufacturer’s requirements for temperature and humidity at time of application.

E. Refer to SDS sheets before using any product.

F. All surfaces must be thoroughly dry before coating applications. Do not apply to wet or damp surfaces.
   1. Wait at least 30 days before applying to new concrete or masonry or follow manufacturer's procedures to apply appropriate coatings prior to 30 days.
   2. Test new concrete for moisture content.
   3. Wait until wood is fully dry after rain or morning fog or dew.

G. Apply coatings using brush or roller only.

H. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendation.

I. Apply coatings using methods recommended by manufacturer.

J. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

K. Apply coatings at spreading rate required to achieve the manufacturer's recommended dry film thickness.

L. Regardless of number of coats specified, apply as many coats as necessary for complete hide.

M. Exterior Woodwork: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 2 weeks.

N. Inspection: The coated surface must be inspected and approved by the Architect or Engineer just prior to the application of each coat.

3.4 CLEAN UP

A. Clean site and remove debris and empty cans daily. Remove all paint from adjacent surfaces. Clean spills and splatters immediately.

B. Clean hands and tools immediately after use with soap and water for water based products and with mineral spirits for oil based products.

C. Follow manufacturer's safety recommendations when using mineral spirits.

3.5 ENVIRONMENTAL REQUIREMENTS

A. Store and apply materials in environmental conditions required by manufacturer's instructions.

END OF SECTION

SECTION 01 45 23 - TESTING

PART 1 - GENERAL

1.1 PULL / UPLIFT RESISTANCE TESTING:

A. Obtain independent third party firm to accomplish field pull testing [uplift resistance] of the existing OSB roof sheathing. Provide documentation to Owner and Architect for review.

B. Results of the pull tests may result in changes to the fastening rates in accordance with the manufacturer's requirements.

1.2 MOISTURE SURVEY

A. No moisture survey was conducted for this project.

1.3 ROOF MOUNTED EQUIPMENT

A. Anchor all existing roof-mounted equipment or provide new support stands to resist, uplift, sliding and overturning in accordance with building code requirements [includes equipment supports to the deck and equipment attachment to supports].

1.4 DRAINAGE TESTING

A. Prior to start of work, test each roof drain / scupper / downspout or other drainage component for proper water flow. Notify Architect / Owner of any clogged, leaking drainage and roof drains that cannot have the roof membrane secured to the existing clamping ring [broken, bolts, etc] or the drain bowl is cracked or bowl pipe connection is leaking/not watertight or piping below drain is leaking, blocked or otherwise not functioning [refer to the drawings]. The contractor shall identify any corrective actions and location of deficiencies. Commencement of work without notification shall constitute acceptance of drainage devices and any costs to unclog or repair these items shall be borne by the Contractor.

END OF SECTION

SECTION 04 01 00 - MAINTENANCE OF MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Repointing masonry, Parging, Water and/or chemical cleaning of masonry surfaces, water repellent.

1.2 SUBMITTALS

A. Product Data: Submit data on cleaning solutions, water repellent.

B. Manufacturer's Installation Instructions: Products selected for use, manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

A. Perform Work according to ACI 530 and ACI 530.1 requirements.

B. Installer: Company specializing in performing Work of this Section with three years' experience.

C. Coordinate work with masonry repairs, re-pointing, limited brick replacement, etc.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Repoint mortar joints and repair masonry only when air temperature is between and 40°f and 90°f and is predicted to remain so for at least 7 days after completion of work.
   1. In accordance with ACI 530.1

B. Hot-weather requirements: protect masonry repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90°f and above.
   1. In accordance with ACI 530.1

C. Patch masonry only when air and surface temperatures are between and 55°f and 100°f and are predicted to remain above 55°f for at least 7 days after completion of work. On days when air temperature is predicted to go above 90°f, schedule patching work to coincide with time that surface being patched will be in shade or during cooler morning hours.

D. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure, work under demolition, or adjacent work to remain.

E. Prevent grout or mortar used in assembly and repair work from staining face of surrounding surfaces. Immediately remove grout and mortar in contact with exposed surfaces.

F. Protect sills, ledges, and projections from mortar droppings.

1.5 SEQUENCING

A. Perform repointing after cleaning masonry surfaces.

PART 2 PRODUCTS

2.1 MORTAR

A. Refer to Section 04 20 00.

2.2 MASONRY RESTORATION AND CLEANING

A. Cleaning Agent: Low Acid Cleaning Solution; Prosoco Sure Klean Light Duty Restoration Cleaner, Sure Klean Restoration Cleaner, or Equal.

2.3 WATER REPELLENT

A. Free flowing, colorless liquid, non water based.
   1. ProSoCo, 'Sure Klean', Weather Seal Siloxane PD'
   2. Diedrich Chemicals, 303S-7 Siloxseal'

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces to be cleaned are ready for Work of this Section.

3.2 PREPARATION

A. Close off and/or seal areas, landscaping, materials, and surfaces not receiving work of this Section to protect from damage.

3.3 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure. Do not use metal scrapers or brushes. Do not use acidic or alkaline cleaners.

B. Clean masonry debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

C. Sweep and rake adjacent pavement and grounds to remove masonry debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt, and stains.

3.4 GENERAL CLEANING

A. As work proceeds and on completion, remove excess mortar, smears, droppings.

B. Clean dirt and light staining from all brick surfaces.

C. If the specified chemicals and cleaning processes do not remove graffiti, paint, or other stains, contact Architect for direction.

D. Perform cleaning working from top to bottom working in sections around the building at one elevation at a time.

E. Use spray equipment that provides controlled application at volume and pressure indicated. Adjust pressure and volume to ensure cleaning methods do not damage masonry.

3.5 REPOINTING MASONRY

A. Joint raking: rake out all joints to be pointed by hand, using a mason's chisel that is not more than 1/4" thick or by approved hand grinding methods. If grinding is used, wet methods are required to minimize dirt and dust. Rake or grind out mortar from joints to depths equal to 2-1/2 times their widths but not less than 1-inch nor less than required to expose sound, un-weathered mortar.
   1. Remove mortar to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum or flush joints to remove dirt and loose debris. No abrasive methods of cleaning shall be used.
   2. Do not spall edges of masonry units or widen joints. Replace masonry units which become damaged.
      a. Do not use power-operated grinders without Architect's written approval based on submission by Contractor of a satisfactory quality-control program and demonstrated ability of operators to use tools without damaging masonry. Quality control program shall include provisions for supervising performance and preventing damage due to worker fatigue.
   3. Replace any units which become damaged.

4. if the existing bricks have worn rounded edges, recess final mortar slightly from face to a point where joint face will not be wider than the original joint.

B. Joint Pointing:
   1. Rinse masonry joint surfaces with water to remove any dust and mortar particles. Time application of rinsing so that, at time of pointing, excess water has evaporated or run off, and joint surfaces are damp but free of standing water.
   2. Apply first layer of pointing mortar to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8-inch until uniform depth is formed. Compact each layer thoroughly and allow to become thumbprint-hard before applying next layer.
   3. After joints are filled to uniform depth, place remaining pointing mortar in 3 layers with each of first and second layers filling approximately 2/5 of joint depth and third layer the remaining 1/5. Fully compact each layer and allow to become thumbprint-hard before applying next layer. Take care not to spread mortar over edges onto masonry surfaces, or to featheredge mortar.
   4. When mortar is thumbprint-hard, tool joints to match original appearance of joints as determined by the architect. Remove excess mortar from edge of joint by brushing.
   5. Cure mortar by maintaining in damp condition for not less than 72 hours.

3.6 PARGING

A. Parge concrete/CMU foundation walls as follows:
   1. Provide all required tuckpointing of mortar joints prior to parging.
   2. Dampen masonry walls prior to parging.
   3. Surface Preparation
      a. Surface preparation is extremely important for proper adhesion. Substrates must be sound, and free of dust, dirt, laitance, paints, oils, grease, curing compounds, or any other contaminants. Verify substrate has properly cured. Concrete should obtain 80% of design strength, typically achieved within 3 to 14 days. If efflorescence is present, mechanically remove it before proceeding.
      b. All holes and cracks must be patched before installation.
      c. Extremely smooth surfaces such as precast and cast-in-place concrete will require roughening or brush blast to ensure good adhesion.
   4. Mixing
      a. Thoroseal is to be mixed with a mixing liquid consisting of a blend of Acryl 60 diluted with water. Dilute and mix per manufacturer requirements.
      b. Refer to manufacturer requirements for blending, consistency, and for pot life.
   5. Application
      a. Thoroseal may be applied with a brush or broom or equivalent stiff fiber brush. Spray application not permitted. The substrate must be completely dampened with water before application starts. Do not saturate the substrate, but keep it cool and damp throughout the application.
      b. It is essential that the first coat be thoroughly worked into the substrate to completely fill and cover all voids, holes, and nonmoving cracks. Finish with a horizontal stroke for an even coat.
      c. Allow to cure 24 hours, then apply the second coat and finish with a vertical stroke. Above grade, the second coat can be replaced with a Thoro high-build architectural coating to achieve better color uniformity.
      d. On block or masonry walls, allow 5-7 days before applying second coat to eliminate joint read through.

3.7 FINAL CLEANING

A. Where re-pointing work precedes cleaning of masonry, allow mortar to harden at least 30 days prior to final cleaning.

B. After mortar has fully hardened, thoroughly clean exposed masonry surfaces using stiff nylon or fiber brush and clean water, spray applied at low pressure.

3.8 SURFACE CLEANING APPLICATION

General: Cleaners shall be installed in accordance with the recommendation of the manufacturer.

A. All masonry surfaced shall be cleaned utilizing a pressure water spray (1,000 p.s.i. max.).
   1. Intent of cleaning program is to remove all surface staining, smoke, dirt, and fungal growth.

3.9 WATER REPELLANT APPLICATION

General: Water repellant shall be installed in accordance with the recommendation of the manufacturer.

A. All masonry surfaced shall have the water repellant installed utilizing a low-pressure water spray (50 psi max.), brush or roller at the rate recommended by the manufacture. Flow coat to saturation point, allow for penetration 5 -10 minutes.

3.10 SCHEDULES

A. General: verify all existing masonry conditions, including anchorage to substrate, to determine scope of masonry repairs. Refer to drawings and additional work allowances to be included in the bid.

B. Limestone Sills: Remove and reset all limestone sills that are loose, displaced, or disbonded. If stone is cracked, broken, or missing, install a new limestone sill to match existing.
   1. Replacement will be a field change if needed.

C. Masonry Repairs:
   1. Remove damaged, cracked, spalled, or dislocated masonry units as required by conditions.
   2. Replace damaged masonry with new or salvaged masonry as applicable to the repair. Install new masonry per Section 04 20 00. Tooth into existing masonry as appropriate.

D. Masonry Tuckpointing:
   1. Tuck point existing mortar joints where indicated and as required by existing conditions.
   2. Tuck point locations of removed hose bibs, address plaques, building equipment, electrical service, conduits, wiring, etc. that were anchored into the mortar joints.

END OF SECTION

SECTION 04 20 00 - UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes concrete masonry units, clay face brick, stone caps, reinforcement, anchorage, mortar and grout, and accessories.

1.2 SUBMITTALS

A. Product Data: For each type of CMU component, clay face brick, stone caps, mortar / mix design, grout, reinforcement, and accessories.

B. Samples: face brick, in the form of straps of five or more bricks to show full color range.

1.3 PERFORMANCE REQUIREMENTS

A. Concrete Masonry Compressive Strength (f'm): 2,000 psi; determined by unit strength method.

B. Clay masonry Compressive Strength (f'm): 3,000 psi; determined by unit strength method.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Assume responsibility for acceptance of masonry units delivered to Project site being in compliance with specified ASTM requirements for chippage and dimensional tolerances.
   1. Inspect decorative units upon delivery to ensure color match with required materials and accepted mock-up panel.

B. Store masonry units on elevated platforms in a dry location to prevent contamination by mud, dust or materials likely to cause staining or other defects. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
   1. Cover masonry units at all times.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
   1. Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands.
   2. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store sand on tarps to keep ground water from wicking into sand.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Temporary measures include application of self-adhered membrane or flashing with long UV exposure. Cover partially completed masonry when construction is not in progress. Continue to cover walls until tie-in to roof is complete and top of wall is protected from water penetration.

B. This structure is designed to be self-supporting and stable after the building is fully completed. Protect masonry walls against wind damage by bracing as required until support of walls is integral with the completed building structure. This includes the addition of whatever temporary bracing, guys, or tie-downs that might be necessary. Safety: It is solely the Contractor's responsibility to follow all applicable safety codes and regulations governing this Work.

C. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure, work under demolition, or adjacent work to remain.

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect sills, ledges, projections, and adjacent building materials / finishes from mortar droppings.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

B. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

C. Patch masonry only when air and surface temperatures are between and 55°f and 100°f and are predicted to remain above 55°f for at least 7 days after completion of work. On days when air temperature is predicted to go above 90°f, schedule patching work to coincide with time that surface being patched will be in shade or during cooler morning hours.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Concrete Masonry Units: ASTM C 90.
   1. Size and Shape: Nominal modular sizes as indicated on Drawings.
      a. Furnish special units for 90 degree corners, bond beams, lintels, jambs, bullnosed corners.
   2. Weight Classification: Normal Weight.
   3. Exposed Faces: Refer to Drawings – smooth face.

B. Face Brick: ASTM C 216, Type FBS, Grade MW, color and texture to match existing brick,
   1. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
   2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   3. Size: Modular, 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

C. Precast Concrete sills: fabricated to suit opening, sized as required. Positive slope out to face of wall, extend 1 inch past face of brick.

2.2 MASONRY LINTELS

A. Prefabricated or built-in-place masonry lintels made from specially formed "U" shaped lintel units with reinforcing bars placed as indicated and filled with coarse grout. Open bottom, bond-beam type units are not acceptable for use as reinforced lintels. Cure prefabricated lintels before handling and installing. Temporarily support built-in-place lintels until cured.
   1. Prefabricated lintels shall have a faux head joint pattern on their exposed faces and shall have their top side clearly marked in the factory. Prefabricated lintels are to be installed such that the faux head joint pattern aligns with that of the surrounding masonry.

2. Knockout blocks are not acceptable.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color(s) indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: ASTM C 150, Packaged blend of Portland cement, Type I or Type III, and ASTM C 270 hydrated lime, Type S.

D. Mortar Cement: ASTM C 1329.

E. Mortar Pigments: ASTM C 979, Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes.

F. Colored Cement: Packaged blend made from Portland Cement and lime, masonry cement, or mortar cement and mortar pigments, all complying with specified requirements.

G. Aggregate for Mortar: ASTM C 144.

H. Aggregate for Grout: ASTM C 404.
   1. Fine Aggregates: ASTM C 404, clean, sharp, natural sand free from loam, clay lumps, or other substances.
   2. Coarse Aggregates: ASTM C 404, clean uncoated, pea gravel containing no clay, mud, load, or foreign matter. Maximum aggregate size 3/4 inch.

I. Water: ATSM C 1602.

2.4 MORTAR AND GROUT MIXES

General: Match original mortar remnants on brick as determined from field sampling and laboratory analysis at the mortar manufacturers plant. Match for color, texture and compressive strength.

A. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade use Type M, where indicated only.
   2. For masonry, use Type S, unless otherwise noted.
   3. For non-load bearing interior partitions, use Type N or S, unless otherwise noted.
   4. For exterior, above-grade, masonry veneer, use Type N or S, unless otherwise noted.

B. Natural [uncolored] Mortar: locations where masonry will be painted.

C. Colored Pigmented Mortar: locations of decorative masonry [non-painted]

D. Grout for Unit Masonry: ASTM C 476.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60, deformed steel bars.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells.

C. Masonry Joint Reinforcement: ASTM A 951, galvanized welded wire mesh.
   1. W1.7 x W1.7 wire mesh unless noted otherwise on Drawings, located at 16 inches on center vertically

2.6 TIES AND ANCHORS

A. Helical Ties: Simpson Heli-Tie Wall Ties or Equal, size and spacing per drawings.

B. Single Wythe Joint Reinforcement: ASTM A951/A951M; truss or ladder type; steel; 0.148 inch diameter side rods with 0.148 inch diameter cross ties; hot dip galvanized.

C. Wall Ties: Corrugated formed sheet metal, 1” x 7” inch size x 20 gage thick; ASTM A153/A153M hot dip galvanized. Provide fasteners suitable for fastening through insulation board into framing [if applicable].

D. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

E. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

F. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.

H. Intersecting Masonry Wall Joint Reinforcing: Where interior masonry walls supported on slabs intersect masonry walls, provide hot dip galvanized 1/2 inch by 16 gauge mesh ties spanning horizontally.

2.7 FLASHING

A. Non-vapor permeable, Self-adhered SBS rubberized asphalt compound laminated to a polyethylene film, specifically designed for thru-wall flashing.
   1. Thickness: 40 mils
   2. Water Vapor Permeance, ASTM E 96: 0.03 perms

2.8 ACCESSORIES

A. Compressible Filler: ASTM D 1056, Premolded filler strips, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

B. Preformed Control-Joint Gaskets: ASTM D 2000, styrene-butadiene-rubber compound, or ASTM D 2287, PVC and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Cellular Plastic Weep / Vent: One-piece, flexible extrusion, UV resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of other wythe.

E. Cavity Mortar Protection Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

F. Elastomeric Tubing Sealant Backings: ASTM D 1056, Grade 2A1, Neoprene, butyl, EPDM, or silicone tubing, non-absorbent to water and gas. Size and shape for conditions.

G. Masonry Cleaners: Manufacturer's standard strength, general purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned. Do not use products containing hydrochloric (muriatic acid, hydrofluoric acid, or ammonium bifluoride).

H. Water Repellent: Apply manufacturer recommended water repellent / sealer to cast stone.

I. Anchors: Non-corrosive type, sized for conditions, hot dip galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Coordinate placement of anchors supplied by other sections.

B. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Coursing of Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Coursing of Brick units:
   1. Bond: Running
   2. Coursing: Three units and three mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

E. Cut mortar joints flush where ceramic wall tile or other wall covering is scheduled, cement parging is required, resilient base is scheduled.

F. Joint Reinforcement And Anchorage - Single Wythe Masonry:
   1. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first joint below top of walls.
   2. Place masonry joint reinforcement in first horizontal joint above and below openings. Extend minimum 16 inches each side of opening.
   3. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches oc.

G. Joint Reinforcement And Anchorage - Masonry Veneer:
   1. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first and second joint below top of walls.
   2. Place masonry joint reinforcement in first horizontal joint above and below openings.
   3. Secure wall ties to stud framed backing and embed into masonry veneer at maximum 16 inches oc vertically and 16 inches oc horizontally.
   4. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb of wall openings.
   5. Place wall ties at maximum 8 inches on center horizontally within 8 inches of head and sill of wall openings.

H. Lintels:
   1. Install loose steel, bond beams or precast concrete lintels over openings.

2. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or indicated.
3. Maintain minimum 8 inch bearing on each side of opening.

I. Grouted Components:
1. Reinforce bond beam and pilasters as detailed.
2. Support and secure reinforcing bars from displacement.
3. Place and consolidate grout fill without displacing reinforcing.
4. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.

J. Masonry Protection: Protect completed masonry and masonry not currently being worked on.

K. Control Joints:
1. Install control joints at the following maximum spacings, unless otherwise indicated on Drawings:
   a. Exterior Walls: 20 feet on center and within 24 inches on one side of each interior and exterior corner.
   b. Interior Walls: 30 feet on center.
   c. At changes in wall height.
2. Do not continue horizontal joint reinforcement through control joints.
3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
4. Install preformed control joint device in continuous lengths. Seal butt and corner joints.

L. Built-In Work:
1. As work progresses, install built-in metal door frames, window frames, anchor bolts and plates and other items to be built in the work furnished by other sections.
2. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings].

M. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
1. Install adjustable hollow metal frame anchors, locating anchors on jambs in horizontal bed courses near the top and bottom of each frame and at intermediate points not over 24 inches apart.
2. Unless otherwise noted or thermal break is required, contractor may grout jambs of hollow metal door and window frames in accordance with ANSI 250.8. Where grout is installed during masonry installation, frames shall be braced or fastened in such a way that will prevent the pressure of the grout from deforming the frame members. Grout shall be mixed to provide a 4 inch maximum slump consistency, hand troweled into place. Grout mixed to a thin “pumpable” consistency shall not be used.
3. Rake joints around exterior side of exterior hollow metal door frames for sealant.
4. Protect inside (concealed) faces of door frames in exterior masonry walls, using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8 inch thick and allow to dry before handling.
5. Where hollow metal frames do not wrap around masonry jambs and heads, rub exposed corners of block to remove sharp, irregular edges.
6. Take particular care to embed all conduits and pipes with concrete masonry without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Where electric conduits, outlets, switch boxes, and similar items occur, grind and cut units before building in services. Prepare cutouts in such a manner that units can be installed plumb and flush.

7. Install anchors, reglets, and nailers for flashing and related work built into masonry work, where indicated.

N. Where built-in items are to be embedded in cores of hollow masonry units, place a grout stop (a layer of metal lath, wire mesh, or plastic mesh) in the joint below and rod mortar or grout into core.

O. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

P. Control Joint Locations in CMU: Provide vertical control joints in reinforced CMU where noted on Drawings and in accordance with the National Concrete Masonry Association, specifically at all offsets, returns, openings, and intersections with dissimilar materials and as follows to prevent cracking:

Q. Flashing: Install embedded flashing and weep vents in first course of masonry above ground level, at lintels, ledges, above doors, windows and other openings and under coping and sills, other obstructions to downward flow of water in wall. Flashing shall be installed longitudinally continuous or terminated with end dams. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities. Comply with NCMA recommendations for “drainage wall system” masonry construction.
   1. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels and turn down on outside face to form drip.
   2. Turn flashing up minimum 8 inches and seal to sheathing over wood framed back-up.
   3. Lap end joints and seal watertight.
   4. Turn flashing, fold, and seal at corners, bends, and interruptions.

R. Weeps: Install weeps in outer wythe at 24 inches oc horizontally above through-wall flashing, at bottom of walls, and other locations where the downward flow of water will be stopped.

S. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes.

T. Cleaning:
   1. Remove excess mortar and mortar smears as work progresses.
   2. Clean soiled surfaces with cleaning solution.

U. Tolerances:
   1. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
   2. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes structural wall and roof framing, built-up structural members, wall and roof sheathing; subfloor sheathing; flashings; preservative and fire retardant treatment; blocking and related furring and framing materials.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. American Wood-Preservers' Association:
   1. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.
   2. AWPA U1 - Use Category System: User Specification for Treated Wood.

C. ASTM International:
   1. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   4. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

D. Forest Stewardship Council:
   1. FSC Guidelines - Forest Stewardship Council Guidelines.

E. Green Seal:
   1. GS-36 - Aerosol Adhesives.

F. National Lumber Grades Authority:
   1. NLGA - Standard Grading Rules for Canadian Lumber.

G. Northeastern Lumber Manufacturers Association:
   1. NELMA - Standard Grading Rules for Northeastern Lumber.

H. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

I. Southern Pine Inspection Bureau:
   1. SPIB - Standard Grading Rules for Southern Pine Lumber.

J. U.S. Department of Commerce National Institute of Standards and Technology:
   1. DOC PS 1 - Construction and Industrial Plywood.
   2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
   3. DOC PS 20 - American Softwood Lumber Standard.

K. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

L. Western Wood Products Association:
   1. WWPA G-5 - Western Lumber Grading Rules.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:
   1. Lumber Grading Agency: Certified by DOC PS 20.

2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.
3. Plywood Grading Agency: Certified by APA.
4. Lumber: DOC PS 20.
5. Wood Structural Panels: DOC PS 1 or DOC PS 2.

B. Perform Work in accordance with Ohio Building Code.

C. Apply label from agency approved by authority having jurisdiction to identify each preservative treated and fire retardant treated material.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

A. Lumber Grading Rules: SPIB, ASLS.

B. Beam Framing: southern yellow pine species, No. 1 grade, 2” and wider size classification, 19 percent maximum moisture content.

C. Joist Framing: southern yellow pine species, No. 1 grade, 2” and wider size classification, 19 percent maximum moisture content.

D. Columns: southern yellow pine species, No. 2 grade, 4” and wider size classification, 19 percent maximum moisture content.

E. Non-structural Light Framing: Stress Group D, spruce, pine, fir species, 19 percent maximum moisture content.

F. Studding: Stress Group D, spruce, pine, fir species, 19 percent maximum moisture content.

G. Sill Plate: AWPA C2 Lumber, Stress Group D, spruce, pine, and fir species, and 19 percent maximum moisture content, pressure preservative treated.

2.2 SHEATHING MATERIALS

A. Wall Sheathing: ANSI A208.1, Oriented Strand Board [OSB]; wood chips set with waterproof resin binder; unsanded faces; 1/2 inch thickness; 48x96 inch sized sheets [match existing conditions]

B. Roof Sheathing: ANSI A208.1, Oriented Strand Board [OSB]; wood chips set with waterproof resin binder; unsanded faces; 1/2 inch thickness; 48x96 inch sized sheets [match existing conditions]

C. Subfloor Sheathing: APA Rated Sheathing Structural I, Span Rating 24/16, Exposure Durability 1, unsanded; 3/4 inch thickness; 48x96 inch sized sheets [match existing conditions]

2.3 UNDERLAYMENT

A. Not Applicable.

2.4 FIREBLOCKING AND FIRESTOPPING

A. Fireblocking: Solid lumber, structural wood panel, or particleboard.
1. Solid lumber nominal 2 inches thick.
2. Structural wood panel 23/32 inch thick with joints backed by structural wood panel.

B. Draftstopping: Gypsum board or OSB
1. Gypsum board: 1/2 inch thick.
2. OSB: 7/16 inch thick.

2.5 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Nails and staples: ASTM F1667.

B. Die Stamped Connectors: galvanized steel, specific type/profile as applicable

C. Structural Framing Connectors: Galvanized steel, sized to suit framing conditions.
   1. Simpson or Equal.

D. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Powder actuated fasteners into slab. Hilti or Equal. All anchors sized to suit application and loads.

E. Sill Gasket: Plate width, closed cell foam strip.

F. Sill Flashing: Polyethylene Sheet or Galvanized Steel.

G. Subfloor Glue: ASTM D3498, water base, waterproof.

H. Weather Resistive Barrier / Building Paper: ASTM D226; spun bonded polyethylene, Tyvek or Equal. Coordinate with existing conditions as appropriate.

I. Self Sealing, Flexible Flashing: 40 mil thick, self-adhesive, cold applied flashing. GCP Applied Technologies, Vycor Flashing or Equal.

2.6 WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA U1, Commodity Specification A-Sawn Products or F-Wood Composites using water-borne preservative with .25 pcf retention.

B. Fire Retardant Treatment: Chemically treated and pressure impregnated, having flame spread of 25 or less when tested in accordance with ASTM E 84 and showing no evidence of significant progressive combustion when test is continued for an additional 20 minute period, Exterior or Interior Type.

C. Moisture Content After Treatment: Kiln dried (KDAT).
   1. Lumber: Maximum 19 percent.
   2. Structural Panels: Maximum 15 percent.

PART 3 EXECUTION

3.1 FRAMING

A. Set structural members level and plumb, in correct position.

B. Fasten framing in accordance with Ohio Building Code.

C. Place horizontal members crown side up.

D. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

E. Provide all required shoring and temporary bracing required to support structure prior to removing any load-bearing components.

F. Construct load bearing framing members full length without splices.

G. Double members at openings. Space short studs over and under opening to stud spacing.

H. Place full width continuous sill flashings under framed walls on cementitious foundations. Lap flashing joint 4 inches.

I. Place sill gasket directly on cementitious foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

J. All exterior framing intended to be left exposed to weather shall be pressure treated and anchored with galvanized fasteners and appropriate connectors.

K. All framing in contact with concrete shall be treated. Interior or exterior walls.

L. Frame new walls, partitions, and openings to suit conditions and as designed.

M. Install solid 2x bearing at each end of beams and headers. Ensure that blocking is positioned with full support/blocking under to existing bearing conditions. Install supplemental blocking as required between joists, framing, etc.

N. Bridge joists at mid-space with solid 2x blocking.

3.2 SHEATHING

A. Install sheathing over framing members in full size sheets in accordance with APA Construction Guide.

B. Fasten sheathing in accordance with Ohio Building Code.

C. Install subfloor sheathing with longer edge perpendicular to floor framing with end joints staggered. Secure sheet edges over firm bearing. Attach sheathing with subfloor glue and appropriate fasteners.

D. Install underlayment in accordance with APA Construction Guide.

E. Secure wall sheathing with ends staggered, over firm bearing.

F. Install new underlayment at areas of wood framed floor systems where required for new finish flooring. Remove all existing underlayment down to original subfloor as required.

G. Place WRB/building paper over wall sheathing, weather lap joints and end laps, staple in place. Coordinate flashing installation to ensure continuous water resistant barrier.

3.3 FIREBLOCKING AND DRAFTSTOPPING

A. Install fireblocking to cut off concealed draft openings as required.
   1. Concealed Framed Wall and Furred Spaces: Install fireblocking vertically at floor and ceiling levels and horizontally.
   2. Connections Between Horizontal and Vertical Spaces: Install fireblocking between vertical walls and partitions and the following:
      a. Horizontal floor and roof framing.
      b. Soffits, dropped ceilings, cove ceilings and other horizontal concealed spaces.

3.4 SITE APPLIED WOOD TREATMENT

A. Treat site sawn cuts. Brush apply one coat of preservative treatment on untreated wood in contact with cementitious materials.

B. Allow preservative to cure prior to erecting members.

3.5 TOLERANCES

A. Framing members: ¼ inch from indicated position, maximum.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY FOR ROOFING

PART 1 - GENERAL

1.1 WORK INCLUDES, BUT NOT LIMITED TO:

A. Miscellaneous sized new wood nailers/blocking, curbs, fascia/trim boards, roof framing members, plywood and associated fasteners, bolts and adhesives as required for installation of the roofing system and sheet metal.

B. Secured existing or new wood members that meet the requirements of Section 07 01 50 can remain in place as per conditions/guidelines and attachment as specified herein. All existing sound decking to be refastened as outlined herein. Review the existing fastening on all remaining wood nailers/blocking and upgrade if necessary to meet the attachment requirements as outlined herein. Any new replacement nailers must be minimum of 1-1/2 inch x 5-1/2 inch [nominal 2x6] unless otherwise noted or conditions dictate otherwise. New nailers shall be elevated/ blocked up to match thickness of new insulation, as applicable.

1.2 APPLICABLE REFERENCES

A. The following references form a part of this specification.
1. NFPA - National Forest Products design specifications.
2. Factory Mutual Research Corporation, Loss Prevention Data Sheet 1-49, Perimeter Flashings.
3. APA - American Plywood Association.
4. Lumber Grading Agency.
5. American Wood Preservers Association
6. State Building Code
7. ANSI/SPRI/FM 4435 ES-1 Edge Systems.
8. WWPA - Western Wood Products Association
9. SPIB - Southern Pine Inspection Bureau
10. ASTM C476 Standard Specification for Grout for Masonry.
11. AWPA - American Wood Protection Association

B. Perform work in accordance with Local Building Code.

PART 2 - PRODUCTS

2.1 DIMENSIONAL LUMBER

A. Board Stock: Graded in accordance with NFPA and Lumber Grading Agency, board class number 2, structural grade, kiln-dried Douglas fir or Southern yellow pine. Moisture content for all lumber shall not exceed 19% by weight at time of installation, including any lumber that can remain in place. Lumber will be removed if moisture content exceeds 19%. Provide fire retardant treated blocking in combustible buildings according to ASTM E84. Sizes as shown are standard nominal sizes. Provide dressed lumber, S4S, unless otherwise noted.
1. Any lumber intended to be left exposed shall be appearance grade, suitable for a painted finish or finish as specified.
2. Where fire retardant treated lumber/materials are indicated, use product with flame spread index of 25 or less in accordance with ASTM E 84.

B. Preservative treated: AWPA, asphaltic, creosote or copper additive [CA & ACQ] type treated lumber is not acceptable for use on this project. Use MQC or CCA [wolmanized] water borne treated lumber complying with C2 and C5 standards for use as nailers on top of concrete or masonry wall surface and other above grade applications. Use treatment that does not promote corrosion of metal fasteners.

C. Plywood decking: Refer to Section 06 10 00.

2.2 FASTENERS

A. General: Contractor to determine the required length for each application in accordance with manufacturer data and Factory Mutual Data Sheet 1-49 recommendations.
   1. Minimum embedment:
      a. Steel-3/4 inch unless otherwise noted.
      b. Wood-1 1/4 inch unless otherwise noted.
      c. Concrete/concrete block [masonry] -1 1/4 inch unless otherwise noted.
   2. Comply with the fastening requirements of the Local Building Code and State requirements, whichever is more stringent.
   3. All fasteners to anchor wood members shall be corrosion-resistant steel unless exposed to weather, pressure preservatives or in high humidity areas, provide fasteners of Type 304 Stainless steel, compatible for the conditions or other requirements stated herein [as noted].
   4. Refer to roofing section for additional fastener data.
   5. Notify Owner if deteriorated substrate conditions exist.

B. Lag Bolts: ANSI/ASME B18.2.1

C. Steel Bolts: ASTM A 307, Grade A

D. Decking Nails: ASTM F 1667 [RSRS-01], 10d, 9 gauge, 0.121-inch diameter [or larger if required by code], ring-shank, corrosion resistant by coating [ASTM A 641 Class 1], flat head.

E. Wood Screws: ANSI/ASME B 18.6.1-81 [2016] or ASTM A 153, corrosion resistance by coating, galvanization or stainless steel.

F. Expansion Anchors: Steel, corrosion resistant, 3/8-inch diameter.

2.3 ADHESIVES

A. Standard wood adhesive, caulk grade.

B. ITW Red Head, A7 acrylic adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect fastening of existing wood members left in place for conformance to requirements specified herein, upgrade as necessary to meet performance criteria outlined.

B. Examine surfaces for satisfactory conditions and do not use materials that are warped, bowed, twisted or unsound.

3.2 INSTALLATION

General: Installation shall be in accordance with Factory Mutual Loss Prevention Data Sheet 1-49 perimeter flashing recommendations and details, Local Building Code, ANSI/SPRI/FM 4435 ES-1, other standard industry framing methods and as shown.

A. Attachment withdrawal resistance criteria for nailers/wood blocking is 250 P/F for perimeter, 300 P/F for corners onto substrate with margins of safety applied from printed values, as follows: Steel, Wood, Structural Steel 2:1, Concrete, 4:1, Gypsum 3:1. No power actuated fasteners or pin drive fasteners allowed. Fastener spacing as outlined below is the maximum allowable, unless otherwise shown on the plans, exception: maximum spacing shall be 18 inches on center in the perimeter and 12 inches on center in the corners [see below].

B. Install members true, plumb and level, secure in place. Provide all required shoring and temporary bracing required.
   1. Use members of continuous possible lengths. Do not use materials with defects or pieces that are too small [optimum joint arrangement].

2. # 8 screws or 10d nails used to secure fascia and top nailers [stacked] to other wood members shall penetrate 1-1/2 inch, apply stacked nailers in two rows at 24 inches on center at perimeters and 12 inches in corners, staggered if feasible.
3. Wood nailers/blocking shall have a ¼ inch space between boards.

C. Metal/Metal and Wood Decks: Wood nailers on deck at perimeter/corners shall be fastened to the deck with two rows of #14 steel, wood to metal deck [Tek] fasteners [wafer head] or #14 HD steel roofing fastener or appropriate #14 wood screw at **24*** inches on center staggered in perimeters and **12*** inches staggered in corners. Start fasteners 3 inches from each end of the board, staggered fasteners 2 inches from edge if nailer is wider than 5 1/2 inches [if existing or stacked wood nailers exceed 6 inches in thickness height consult RDA for fastener selection]. An alternative method, when nailers/blocking are parallel to deck ribs, the nailers can be attached to the structural members [joists] with 3/8-inch steel bolts/nuts or Tek/5 self-tapping fasteners, 7 feet on center max. spacing. All fasteners must penetrate the top flange of the deck and be driven flush or countersunk, if necessary.

D. Steel Members: Wood nailers at perimeter/corners shall be fastened to a steel member with one row of #14 or 1/4-inch steel, wood to metal deck [Tek/5 self-tapping fasteners] at 18 inches on center, centered, stagger fasteners 2 inches from edge if nailer is wider than 6 inches; pre-drill holes and countersink, if necessary. Fasteners shall start 3 inches from each end of the boards and shall be spaced **16*** inches on center each way from the corner.

E. Concrete Block/Concrete, Stone and Concrete Decking: Wood nailers at perimeter/corners or on top of parapet wall shall be fastened with one row [two rows if nailer is over 5 1/2 inches wide] of 1/4-inch self-tapping fasteners at **24*** inches on center [offset or staggered] in perimeters and **16*** inches [offset or staggered] in corners-each way. Fasteners shall be spaced 2 inches from edge if nailer is wider than 5 1/2 inches; pre-drill holes and countersink, if necessary. Fasteners shall start 3 inches from each end of the boards [if existing or stacked wood nailers exceed 6 inches in height consult Architect for fastener selection] or use a 3/8-inch diameter treaded rod placed into a pre-drilled hole with adhesive injected for a solid substrate, bolt boards to rod. Rods placed at 3 feet on center in the perimeter and 2 feet on center in corners-each way. Cores of hollow block must be completely filled with grout [forming a bond beam] where rods are located. Embed rods 5 inches minimum into filled block cores or solid block/concrete.

F. Plywood Sheathing. Install replacement sheathing in full sheet onto existing rafters/joists/trusses. End joints should be directly over center of rafters/joists/trusses and be attached with 10d ring shank nails spaced *6* inches on center at the perimeter and 12 inches on center at field of each panel at each rafter/joist/truss [nail penetration into rafters/joists/trusses,2 inches]. All existing sound decking shall be refastened to ensure a fastener is spaced no further than 6 / 12 inches. Joints in the next board should not occur in the same structural member space. No decking boards shall be used that are not long enough to span over two structural members, if applicable. Steep Sloped Application: Allow a two-inch space on each side at the ridges for proper ventilation to occur from the ridge vents, if ridge vents are required. In addition, provide u-shaped expansion clips between sheets that are not nailed in place.

3.3 SURFACE TREATMENT

A. All exposed to view newly installed wood members shall be primed and painted to match surrounding adjacent surfaces colors, unless otherwise noted.

END OF SECTION

SECTION 07 01 50 – PREPARATION FOR REROOFING

PART 1 – GENERAL

1.1 WORK INCLUDES, BUT IS NOT LIMITED TO:

General: Roof Membrane Removals and Other Removal Summary [Refer to section 01 45 23 for deck testing requirements]: Roof Replacement at Buildings 1503 and 1515 Linn Street only.

Roofs A-1, A-2, C-1 and C-2: Remove the entire roof system down to the structural wood deck. Removal includes EPDM membrane, insulation, fasteners, flashings, and other rooftop components, see other removals below.

Roofs B-1, B-2, B-3, B-4, B-5, B-6, B-7, B-8, B-9, and B-10: Remove the entire roof system down to the structural wood deck. Removal includes EPDM membrane, tapered insulation, fasteners, flashings, and other rooftop components, see other removals below.

A. Removal of existing perimeter base flashing [metal, EPDM / single ply as applicable] and associated equipment supports and related items.
   1. Removal and reinstall existing electrical conduits, cable lines and associated wall attachments.

B. Removal of wood nailers and blocking. Wood members that are securely bolted or adequately fastened or can be adequately fastened to the structure per the specifications and are in a dry good condition can remain in place as a base for new members or sheet metal items. Remove deteriorated and damaged wood members. [Refer to section 06 10 53 for anchoring requirements].

C. Removal of sheet metal items such as copings, edges, scuppers, conductor heads, downspouts, skirt flashings, counter-flashings, penetration pockets, pipe flashings, equipment supports and like components necessary for application of new membrane.

D. Removal of existing unused curbs, membrane repairs, abandoned equipment as noted in the drawings.

E. Removal of existing curbs, vents and covering of associated openings as noted on the drawings.

F. Removal of defective existing roof drains and replacing/reworking drain components.

G. Other removals are necessary to accomplish the new work.

1.2 QUALITY ASSURANCE

A. Work shall be performed in strict accordance with the terms and conditions of all municipal and state regulations and local codes.

B. Demolition shall comply with the requirements of ANSI - American National Standard Safety Requirements for Demolition.

C. Conduct demolition work in a manner that will minimize disruption of Owner’s normal operations. Coordinate work activities daily with Owner.

D. Properly protect all facility surfaces and associated landscaping from damage due to normal demolition operations. Return all areas to their original condition at no charge to the Owner.

E. Drainage Testing: The contractor shall test each roof drain, downspouts/scuppers and other drainage elements for proper water flow before commencement of work. Commencement of work shall constitute acceptance of drainage device and any costs to unclog or repair these items shall be borne by the Contractor.

F. Do not remove existing roofing membrane or components when weather conditions threaten the integrity of building contents.

G. Field pull testing is required prior to commencing with work. All test results must meet the design pressures, manufacturer's requirements [deck/membrane resistance], requirements by the state building codes.

1.3 OCCUPATIONAL SAFETY and HEALTH ADMINISTRATION [OSHA]:

A. Walking working surfaces and fall protection standards, 29 CFR 1926.501 [b][1].

1.4 COORDINATION

A. All utilities and mechanical rooftop equipment will remain active during normal work hours, unless approved otherwise by the Owner.

B. All removals shall be legally disposed of, except those indicated to be reinstalled, salvaged or to remain Owner's property. Comply with hauling and disposal regulations of authorities having jurisdiction and EPA notification regulations.

1.5 FIELD CONDITIONS

A. Do not overload the structure with storage of materials, verify roof deck weight capacity and location of structural supports; only items needed that day shall be stored on the roof. Limit loads on roof to 25 pounds per square foot for uniformly distributed loads for metal / wood decks, 75 pounds per square for concrete decks. **Provide temporary securement of existing membrane to prevent membrane blow off while installing new roof system, if applicable.**

B. Do not apply the roofing system during inclement weather or when the chance of precipitation is 40% or greater, as listed on www.weather.com for the local area, when read at 7 AM local time or at time of work commencement. Proceed with roofing and associated work when weather conditions permit unrestricted use of materials and quality control of the work being installed.

C. Building space underneath roof work is utilized by on-going operations. Coordinate all work with the Owner including material storage and contractor parking. Owner's approval required before proceeding with the work. **Contractor must provide overhead protection for Owner's workers, public, visitors, etc from falling materials/debris at building entry points.**

1.6 **ALLOWANCES**.

A. Refer to Section 01 20 00.

PART 2 - **PRODUCTS**

NOT USED

PART 3 **- EXECUTION**

3.1 ROOF REPLACEMENT PREPARATION/EXAMINATION

A. All Roof Areas**.** Removal of all moisture, and other materials/debris from existing decking that inhibits new roofing materials from conforming to substrate, including power blowing of deck surfaces.

B. Verify that surfaces and site conditions are ready to receive work. Verify that deck is clean and smooth, free of depressions, irregularities, or projections and properly leveled, and the condition of the wood decking is suitable for re-roofing. Replace all damaged, deteriorated, rotted, or soft decking. Start of work constitutes acceptance of conditions.

C. Verify that all wood blocking, nailers are securely anchored in place.

3.2 DECK PREPARATION/REPAIRS

A. Wood Deck: Refer to Section 06 10 00.

3.3 DUST / FUME CONTROL

A. Take measures to avoid dust, dirt and debris from entering the building.

B. Throwing material off the roof is prohibited; provide an enclosed chute, crane or raised dump truck to remove roofing materials.

C. Provide a tarp and any or all other protection of walls / finish surfaces where material is being removed.

D. Take special precautions around deck penetrations, including but not limited to installation and removal of reinforced visqueen below the roof deck to protect property below.

E. Special precautions shall be taken to prevent fumes from entering the facilities through air intakes. Provide charcoal filters or other filtration media as necessary.

3.4 TRAFFIC

A. Conduct demolition operations and the removal of debris to ensure minimum interference with streets, walk and other adjacent facilities. Do not close or obstruct streets or walks, without permission from Owner and authorities having jurisdiction.

3.5 DISPOSAL OF MATERIALS

A. Remove from the site all debris, rubbish and other materials resulting from the demolition operations, are not being reused as soon as possible. The landfill used for disposal shall be approved for the type of materials being disposed of. Comply with local laws and EPA regulations when transporting materials from the site.

B. All materials that are to be reused in the new work shall be removed, cleaned and stored in a safe place until reinstallation, as applicable.

3.6 ASBESTOS REMOVAL / NOTIFICATION

A. If asbestos is found during the course of work, all removals shall be in accordance with written guidelines provided by OSHA Asbestos Construction Standard [29 CFR 1926.1101], and State, County and EPA guidelines as applicable. The contractor must be OSHA trained meeting the requirements of 29 CFR 1926.1101 for the removal, handling and monitoring of removed material. Transport and disposal of asbestos shall follow 40 CFR 61, Subpart A, 49 CFR 171 and 49 CFR 172. **No asbestos was found in the existing roof membranes.**

B. When applicable, indicate receipt and acceptance of hazardous wastes, such as asbestos containing materials, by a landfill licensed to accept such materials. Notify and provide all documentation to the Owner for disposal of asbestos. All costs for asbestos removal, permitting and handling will be included in the bid if noted herein. The owner will engage with an approved firm to provide an asbestos containing survey for the roof membranes that are to be removed in accordance with the contract documents. The results of this survey will be provided to the bidders prior to the bid due date.

C. All asbestos removals shall be done in a manner that does not cause the roofing fibers to become crumbed, pulverized, or airborne, these materials shall be handled as Category I and II non-friable asbestos. Should asbestos be encountered noted or not, that has become friable due to the actions of the Contractor or the condition of the material, the Contractor shall secure the services of an abatement contractor to remove the material and an independent firm to monitor removal activities and procedures [removal plan required]. The contractor shall pay for this abatement contractor if asbestos became friable due to their removal procedures. Notify Owner's rep if asbestos has been encountered that was not noted, prior to removal.

3.7 UTILITIES / EQUIPMENT

A. Where electrical lines, refrigerant line sets, equipment, controls, etc. interface with the performance of the work, they shall be temporality removed, replaced and made fully operational as soon as possible, a 48-hour notice and approval from Owner is required before any removals can take place. The Contractor has the responsibility to verify the operational status of all equipment before removals take place.

B. The Contractor must notify the Owner of any non-operational items prior to removal; commencement of work constitutes acceptance of equipment and any costs to make operational shall be borne by the Contractor.

END OF SECTION

SECTION 07 46 00 - FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes fiber cement lap siding, fiber cement sheet siding, fiber cement trim, composite trim, flashings, accessories, and fastenings.

1.2 SUBMITTALS

A. Product Data: Submit data indicating materials, component profiles, fastening methods, jointing details, sizes, surface texture, finishes, and accessories.

B. Samples: Submit two samples illustrating surface texture and color.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 3 years' experience with installation of similar products.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Remodel mock-up area as required to produce acceptable work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 WARRANTY

A. Limited product warranty against manufacturing defects for 30 years, non pro-rated

PART 2 PRODUCTS

2.1 FIBER CEMENT SIDING

A. Non-asbestos fiber-cement siding to comply with ASTM C1186, Grade II, Type A; ASTM E 136, non-combustible materials.
   1. Hardie Artisan HZ5 lap siding.

B. Manufacturers:
   1. James Hardie [basis of design]
   2. Approved Equal.

C. Siding to meet the following building code compliance National Evaluation Report NER 405; US Department of Housing and Urban Development Materials Release 1263. Non-asbestos fiber cement siding to be non-combustible when tested in accordance with ASTM E136.

D. Lap Siding:

1. Hardie Plank Lap Siding HZ5 lap siding as manufactured by James Hardie Building Products, Inc.
2. Width: 8-1/4 inches with 7 inch exposure.
3. Length: 12 feet.
4. Finish: Smooth

E. Panel / Sheet Siding:
1. Hardie HZ5 Panels as manufactured by James Hardie Building Products, Inc. A non-combustible fiber-cement panel.
2. Product Composition: Grade II, Type A, fiber-cement sheets as defined by ASTM C1186. manufactured by the Hatschek process and cured by high pressure steam autoclaving.
3. Size and Profile: 48 inch x 96 inch sheets x .312 inch thickness
4. Finish: Smooth

F. Trim: Hardie HZ5 boards
1. Width: as noted on drawings.
2. Thickness: 3/4 inch and 1 inch as noted on drawings.
3. Finish: Smooth

G. Trim Accessories: As applicable to the installation

2.2 COMPOSITE TRIM

A. Exterior synthetic/composite trim, ASTM C 1185
1. Manufactured by Boral TruExterior Trim or Equal

B. Properties:
1. Density, ASTM C 1185, 40 to 50 pcf.
2. Water Absorption, ASTM D 570: Less than 1.5 percent.
3. Fungi Rot, AWPA E10:
   a. White Rot: Negligible Loss.
   b. Brown Rot: Negligible Loss.
4. Termite Resistance, AWPA E1: Greater than 9.0 with 10 being impervious.
5. Flexural Strength, ASTM C 1185: Greater than 1,600 psi
6. Nail Withdraw, ASTM D 1761: Greater than 50 lbf/in.
7. Coefficient of Linear Expansion, ASTM D 6341: 1.40E-05 in/in/degree F
8. Flame Spread, ASTM E 84: Between 25 and 29.
9. Smoke Developed, ASTM E 84: Less than 450.

C. Trim Sizes: Coordinate with drawings as applicable.
1. Exposed Texture: Smooth.

2.3 PRE-FINISHING

A. Factory applied primer system.

B. Field applied final paint coating, Refer to Section 09 90 00.

2.4 FASTENERS

A. Wood Framing: 16 gauge, galvanized ring shank nails or screws as applicable to the installation and meeting manufacturer requirements.

2.5 ACCESSORIES

A. Flashings: 26 gauge thick metal to match siding color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify framing conditions are within allowable tolerances without twists, bows, waves, etc.

B. Verify weather resistive barrier is installed and wall surfaces are ready to receive siding.

C. Nominal 2 x 4wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches face and straight, true, of uniform dimensions and properly aligned.
   1. Install water-resistive barriers and claddings to dry surfaces.
   2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
   3. Protect siding from other trades.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install water-resistive barrier.

D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

E. Install Weather Barrier in accordance with local building code requirements.

F. Install Seam Tape at joints, penetrations, and laps.

G. Install flashing where applicable in accordance with manufacturer's requirements.

3.3 INSTALLATION

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Install over braced wood. See General Fastening Requirements. Irregularities in framing and sheathing can mirror through the finished application. Correct irregularities before installing siding.

C. A water-resistive barrier (WRB) is required in accordance with local building code requirements. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

D. When installing horizontally, a WRB with min. 90 percent drainage efficiency shall be used.

E. Adjacent finished grade must slope away from the building in accordance with local building codes - typically a minimum of 6 inches. in the first 10 ft

F. Do not install that product remains in contact with standing water.

G. Installed on flat vertical wall applications only.

H. Install flashing around wall openings, etc.

I. Trim/Fascia and Rake
   1. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate a minimum of 3/4” into framing or full thickness of sheathing. Additional fasteners may be required to ensure adequate installation. Place fasteners no closer than 3/4” and no further than 2” from side edge of trim.
   2. Trim inside corners with a single board.
   3. Install single board at outside corner then align second corner board to outside edge of first board. Do not fasten trim board to trim board.
   4. Allow 1/8” gap between trim and siding.

J. Siding:
   1. Install materials in strict accordance with manufacturer's installation instructions.
   2. Install metal Z flashing and provide a 1/4 inch gap at horizontal panel joints.

3. Place fasteners no closer than 3/8 inch from panel edges and 2 inches from panel corners.
4. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
5. Maintain clearance between siding and adjacent finished grade.
6. Specific framing and fastener requirements refer to Tables 2 and 3 in International Code Council Evaluation Report No. ESR-2290.
7. Use off-stud metal jointer when vertical joints occur between framing members.

K. Align level, and plumb.

L. Install metal flashings at sills, head of wall openings, and all areas required by siding manufacturer.

M. Seal watertight.

3.4 FINISHING

A. Apply full finish field coating over the factory primed siding and trim. Refer to Section 09 90 00.

END OF SECTION

SECTION 07 53 00 – SELF-ADHERED EPDM ROOFING, INSULATION AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDES, BUT NOT LIMITED TO:

General: Intent of project is to provide a functional 20-year new watertight roof system, resisting wind uplift pressures, thermally induced movement and exposure to weather without failure. Roof system must have been tested by an approved testing agency and have field experience by the manufacturer. Provide and install all roof components and accessories for a complete watertight roof system.

A. Clean and dry deck surface [repair / replace decking as required by field conditions].

B. Installation of a new EPDM roofing system, self-adhered system [see roof schedules].

C. Installation of new flat stock and tapered insulation, tapered insulation saddles.

D. Installation of new membrane flashings and roof accessories.

E. Raising existing curbs on mechanical units, vents, etc and rework, disconnect/ extend ducting/ electrical /gas lines to accommodate new insulation heights, flashings, penetration covers, and sheet metal as required. Electrical connections/utility hookups removed and reinstalled by Electrical contractor. Purge and recharge all removed HVAC units by HVAC contractor.
   1. All work required for plumbing, mechanical, and electrical disconnect and reconnect, rework, etc. as necessary for the proper execution of the work shall be included within the Contractor's scope – this will NOT be accomplished by the Owner, unless specifically noted.
   2. Sub / Trade Contractors must be approved by Owner. In some cases, there may be maintenance contracts, preferred vendors who work on the building and understand the intricacies of the existing building systems that must be utilized.

F. Installation of new A/C condenser unit stands, curbs and other roof top units stands, curbs etc. includes approved tie down/stands, as shown, as applicable.

G. Installation of roof pavers.

H. Installation of walk pads.

1.2 APPLICABLE REFERENCES

A. The following references form a part of this specification.
   1. ASTM C 1289-13 Polyiso Insulation Board, Type II, Class 2, Grade 2 and HD Cover Board, Type II, Class 4, Grade 1
   2. ASTM E108 Fire Test of Roof Coverings.
   3. [FMG] Factory Mutual Global - Current Approval System [NAV assembly numbers], Loss Prevention Data Sheets for Roof Deck Securement for Above Deck Roof Components, Perimeter Flashings, Wind Design-ANSI/FM 4474, Approval Standard FM 4470 and Roof Loads for Construction
   4. [UL] Underwriters Laboratories - Roofing Materials and Systems Directory, Fire Resistance Directory, Current Edition.
   5. [NRCA] National Roofing Contractors Association - Current Roofing and Waterproofing Manual.
   6. [AISC] Manual of Steel Construction
   7. [OSHA] Occupational Safety and Health Administration, Guidelines
   8. [ASCE] 7-10 Minimum Design Loads for Buildings
   9. [ANSI/SPRI/FM] 4435 ES-1 Wind Design for Edge Systems
   10. [NFPA] National Fire Protection Association, 58 Liquefied Petroleum Gas Code
   11. [ANSI/SPRI] WD-1 Wind Design Standards
   12. ANSI/SPRI] Field Uplift Resistance of Fasteners and Adhesive.

13. ASTM D4637, Type 1 Ethylene Propylene Diene Monomer [EPDM].
14. ASTM D1177 Gypsum Board

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing EPDM roofing membranes specified in this section, with minimum 10 years' experience.
   1. All roofing materials supplied must be manufactured or manufacturer approved by the company furnishing the warranty including the metal roof edge and coping [if integrated in the roof membrane] - **single source responsibility**. The manufacturer must manufacture the membrane material furnished as a minimum.
   2. The roofing material manufacturer [manufacturer of record] must submit a letter stating that the applicator is approved to use the products as furnished, is licensed to install their material in the state in which the project is located, that the applicator can obtain the warranties as outlined in the specifications in accordance with the roof system requirements and details as drawn and the products are acceptable for use on the surfaces to which they are being applied. In addition, an outline of the roofing system components product name and their securement requirements shall be included with the letter.

B. Applicator: Company specializing in applying single ply roof systems with minimum 5 years documented experience, never been terminated by a manufacturer for workmanship problems, be approved for minimum 5 years by the manufacturer for use of their materials and can provide the warranties as specified. No deviations from the roof membrane products specified herein unless approved by the owner.

C. Inspection: Prior to, during mid-point installation and at completion, an inspection shall be made by the manufacturer's representative to assure that the roofing system is/has been installed in accordance with their requirements and recommendations.
   1. An inspection status report at mid-point of construction shall be prepared by the manufacturer's rep, no later than 3 days after the inspection and provided to Architect.

D. Training: The roof foremen or at least 1 assistant working on this project must either be a 'Journeymen Roofer' or have attended and completed the roof material membrane manufacturer's approved installation course herein within the last two years of the bid date with the membrane/s specified herein. [**Certificate of proof required or letter from manufacturer as part of the submittal]**. Roof foremen must have a minimum of 5 years' experience with application of EPDM roof systems and be able to interpret specifications and drawings [Contract documents must be always on-site].

E. Drainage Testing Requirements: Refer to Section 01 45 23

F. Provide waterproof tarp[s] on site for temporary protection in the event of sudden inclement weather.

G. Provide any power necessary to accomplish the work, Owner may or not provide power.

H. Existing membrane penetrations or leak sources within work area must be repaired watertight before commencement of new work.

I. Locate any conduit / lines which may be located directly under the deck prior to using penetrating deck fastener to avoid puncturing lines. Coordinate inspection with Owner. Relocate [at Owner's expense] any conduit / lines necessary. Repair any conduit / lines which are damaged / penetrated at Contractor's expense].

1.4 REGULATORY PERFORMANCE REQUIREMENTS

A. Fire Hazard Classification: Underwriters Laboratories [UL], Use only Class A fire-rated materials as tested in accordance with ASTM E 108 or UL 790 for exterior fire. The roof system must be a Class A rated system.

B. American Society of Civil Engineers [ASCE], Factory Mutual Global Corporation [FMG], Roof Material Manufacturer, NRCA: Materials must meet the intent of the test criteria set forth in FMG/ANSI standard 4474 and ANSI/SPRI WD-1 to resistance the uplift wind design pressures as noted on the drawings, to support internal/external fire, to support corrosion resistance fasteners/anchors. The roof membrane manufacturer in compliance with the building code and FM NAV assembly if required must provide the roof assembly securement requirements to resist the wind pressures as noted along with meeting the roof warranty wind requirements and other requirements as shown and outlined in the specifications. The manufacturer's roof assembly securement must not be less stringent than the ASCE 7-16 calculations and must be successfully tested to resist wind uplift pressure according with ANSI/SPRI WD-1 standard. A field pull [ANSI/SPRI FX-1] or adhesion test [ANSI/SPRI 1A-1] will be necessary prior to commencing work when conditions are different then manufacturer's assembly test criteria for their approval to meet the design pressures or required by the building code or be conducted per Architect's request. If a test has been completed the results will be provided herein.

C. Occupational Safety and Health Administration [OSHA] 29CFR 1926:
   1. Asbestos roof materials training for the removal, handling and monitoring.
   2. Roofing safety requirements for torch application.
   3. Walking working surfaces and fall protection standards.

1.5 **STATE/FACTORY MUTUAL [FM] APPROVALS AND STANDARDS** *[these approvals/standards reference the design products contained herein. Equal products must provide applicable product approvals]. Approvals and numbers must be verified by the manufacturers technical department.*

A. AMERICAN SOCIETY OF CIVIL ENGINEERS - Minimum Design Loads for Buildings and Other Structures.
   1. ANSI/ASCE Revision 7-16 - refer to wind pressure zones on the drawings.

1.6 COORDINATION

A. Daily reporting by the Contractor is required.
   1. Email project team daily with outline summary of work accomplished, any problems encountered such as bad deck, etc.
   2. Email project team on days when weather prohibits work to indicate a 'weather day.'

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not overload the structure with storage of materials, verify roof deck weight capacity and location of structural supports, only items needed that day shall be stored on the roof. Limit loads on roof to 25 pounds per square foot for uniformly distributed loads for metal/wood decks, 75 pounds per square for concrete decks. Provide temporary securement of existing membrane to prevent membrane blow off while installing new roof system.

B. Store and protect products in accordance with manufacturer's instructions.

C. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact. All materials must be UL or FM labeled.

D. Store products in weather-protected environment [manufacturer's plastic wrap is accepted for proper protection, unless wrap is broken, torn, removed], clear of ground 4 inches min. and moisture. Use breathable tarps for moisture protection as needed. Protect unwrapped foam insulation and liquids from direct sunlight exposure. Water damaged materials will be marked 'rejected' by the Contractor/Owner or Architect and removed from the site.

E. Storage of flammable liquids in buildings is prohibited. All combustible debris shall be removed from the site daily.

F. Storage shall be in areas designated by Owner.

1.8 WEATHER CONDITIONS

A. Do not apply the roofing system during inclement weather or when the chance is 40% or greater, percentage as listed on www.weather.com for the local area, percentage as listed when read at 7 AM local time or at time of work commencement. Proceed with roofing and associated work when weather conditions permit unrestricted use of materials and quality control of the work being installed.

B. Do not apply roofing system to damp or frozen deck surface.

C. Adverse weather conditions e.g. extreme temperature, high winds, high humidity, and moisture could have a detrimental effect on adhesives, contact manufacturer for acceptable tolerances. See additional restrictions specified herein.

1.9 SEQUENCING AND SCHEDULIING

A. Building space underneath roof work is utilized by on-going operations. Coordinate all work with Owner including material storage and contractor parking. Owner's approval required before proceeding with the work. Contractor must provide overhead protection for Owner's workers, public, visitors, etc from falling materials/debris at building entry points.

B. Coordinate the work of installing all associated items in such sequence that will not necessitate movement of workers and equipment over completed roof areas.

C. Sequence daily work of new roofing to be limited only that can be covered and made 100% watertight at the end of each day, including full adhesion of the membrane, flashings and night seals. No temporary roofing shall be allowed unless approved by the owner.

1.10 MANUFACTURER'S WARRANTIES

A. Provide a manufacturer's warranty for both repairs/replacements due to any faults in the material and workmanship [Total System Responsibility]. Any leak repairs/replacement due to normal wear and tear, membrane defects, workmanship defects, damage due to wind speeds up to 72 mph [10 meters above ground], shall be performed at no charge to the Owner throughout the period of the warranty. Roof warranty shall be a no dollar limit type [NDL] with no penal sum, covering all insulation, fasteners, membrane, flashings, liquid flashing, metal coping/edging, regardless of the manufacturer. The warranty must be transferable and must be signed by the Manufacturer of record and the Owner, if required. When a contractor warranty is provided or implied, this warranty must bind the Manufacturer and Contractor, for the terms of their agreement, to perform any necessary repairs/replacements for the term of the contractors warranty [in most cases two years].
   1. .060-inch-thick EPDM Roof Membrane shall be warranted for [20] twenty years.

B. In the event of a default by the Contractor, the Manufacturer will provide a new contractor to fulfill the warranty obligation.

1.11 PORTABLE FIRE EXTINGUISHERS

A. Two standard listed multipurpose dry chemical fire extinguishers, NFPA 10, with 10-pound capacity and an ABC UL rating shall be provided and located 20 horizonal feet from the work area. Additional fire extinguishers shall be provided for different roof levels/work sites.
   1. Ensure all personnel are trained to use fire extinguishers.

PART 2 PRODUCTS

General: All products shall be Building Code approved as applicable, meeting all manufacturers full system roof warranty requirements.

2.1 ROOFING SYSTEM DESCRIPTIONS

General: System Assembly Applications/Scopes, Roof Removal and Replacement.

A. Manufacturers and Membrane Products and Membrane Designation: [Single Ply]: Ethylene Diene Monomer [EPDM] .060 inches thick, non-reinforced, self-adhered, color black.
   1. Elevate, RubberGuard EPDM SA.
   2. Carlisle SynTec., Sure-Seal EPDM, SAT with factory applied tape.
   3. Johns Manville, EPDM FIT SA

B. Insulation [polyisocyanurate] Manufacturers:
   1. Elevate, ISO 95+GL
   2. Carlisle SynTec, InsulBase
   3. Johns Manville, ENRGY 3

C. Base Flashing Designations: same as roof system unless manufacturer requires a different product for their warranty or as noted herein. Use manufacturer approved liquid membrane system product for flashing conditions where flashing height is less than 6 inches and unusual shaped metal supports and other areas as required by the manufacturer where noted or as required by condition. Use manufacturer approved molded products where liquid flashing system will not provide a watertight condition.
   1. Other Flashing Designation- Manufacturer's approved details for 20-year warranty.

Contractor's quote must match the roof system including all components and application procedures [cover board, fasteners, membrane and etc.] The roofing schedules set the parameters for the roof system assembly and its application procedures.

ROOFING SYSTEM SCHEDULES

ROOF SYSTEM [EPDM]

Low Sloped Wood Deck [Roof Areas A-1, A-2, C-2, and C-2]

Deck:	OSB deck [sloped]
Preparation:	See Preparation for Reroofing and the proposed roof matrix.
Vapor Barrier:	None
Insulation:	One-layer, flat stock, 1.5 inches thick, fastened into the wood deck at the fastening rates established by manufacturer for warranty. Provide tapered insulation saddles where required.
Cover Board:	None.
Membrane:	One ply EPDM membrane, self-adhered to the new cover board.

ROOF SYSTEM [EPDM]

Flat Wood Deck [Roof Areas B-1, B-2, B-3, B-4, B-5, B-6, and B-7]

Deck:	OSB deck [flat]
Preparation:	See Preparation for Reroofing and the proposed roof matrix.
Vapor Barrier:	None
Insulation:	1/8 inch per foot tapered insulation system [full tapered design], starting thickness of 1/2 inch, fastened into the wood deck at the fastening rates established by manufacturer for warranty. Provide tapered insulation saddles where required.
Cover Board:	None.
Membrane:	One ply EPDM membrane, self-adhered to the new cover board.
Overburden:	Rubber / Composite Roof Deck Pavers

2.2 SHEET MATERIALS/COMPONENTS

General: all membrane component flashings, etc shall match the same color as the membrane.

A. Elastomeric Sheet: ASTM D4637, type I, class A material, cured, synthetic, non-polyester reinforced, self-adhered, single ply membrane composed of Ethylene Propylene Diene Monomer [EPDM], BLACK, .060 inches thick.

B. Membrane Flashing: ASTM D4811, Type II, .055 -.060 inches thick, black, non-reinforced, semi-cured, synthetic, single ply EPDM.

C. Self-Adhesive Flashing: un-cured .045 inches thick, EPDM membrane laminated to 35 mil EPDM tape adhesive.

D. Lap Splice Tape: .035 inches thick, EPDM-based, formulated for compatibility w/EPDM membrane, self-adhering, cured, width as required.

E. Adhesive Primer: Solvent based synthetic rubber based formulated for compatibility w/EPDM membrane.

F. Splice Adhesive: Synthetic polymer-based, if required.

G. Bonding Adhesive: Primer for vertical surfaces.

H. Water Block Seal: Butyl rubber sealant.

I. Splice Cleaner: Organic solvent mixture.

2.3 INSULATION AND COVER BOARD

General: All flat stock, tapered insulation and / or cover board shall be from the same manufacturer. Board configuration: 48-inch x 96-inch thickness [mechanically fastened] or 48-inch x 48-inch thickness for adhered [adhesive] applied. Board configuration for tapered insulation: 48-inch x 48-inch. Mixing of insulation panels from different manufacturers is not acceptable. All insulation/cover board shall be supplied and approved by the membrane manufacturer and must meet FMG 4450 or UL 1256 as a tested assembly.

A. Flat Board Stock: ASTM C1289, closed cell polyisocyanurate, square edge/rigid board, type II, class 2, **grade 2**, coated bonded inorganic glass fiber reinforced mat facers on both sides, square edges, **minimum 20 psi compressive strength**, size boards as approved for application and by the roof membrane manufacturer.
   1. Includes in-fill for tapered saddles and/or insulation. Thickness as outlined.

B. Tapered: ASTM C1289, closed cell polyisocyanurate rigid board; type II, class 2, **grade 3**, coated bonded inorganic glass fiber reinforced mat facers on both sides, factory tapered, **minimum 25 psi compressive strength**, size boards as approved for application and as supplied by the roof membrane manufacturer. The roofing contractor and the tapered insulation manufacturer designer must assume design/application responsibility for the performance of the submitted tapered insulation layout.
   1. **Tapered and Saddle insulation** shall be sloped at 1/8 inch per foot. *Tapered insulation starts at 1/2 inch thick. Tapered insulation saddles starts at 1/2 inch thick.*
   2. Saddles: Each side of the saddle width shall be as shown or 25% of the drain to drain [whatever is less], if spanning between two or more drains as applicable for conditions.
   3. Drains Sumps: Tapered min. 1/4 inch per foot slope drain sumps are required at all drains, if conditions allow [size, 4-foot square].

2.4 CANTS / EDGE

A. Cant Strips and Tapered Edge Strips: Perlite, fire resistant, performed to 45 degree angle and 18 inch long tapered edge strip, tapered front to back as required by the Manufacturer.

2.5 ROOF FASTENERS AND ACCESSORIES *[some items may not be required for this project]*

General: Fasteners/Anchors: strength, type and configuration must meet the required pull test resistance for each attachment application. Fastener's rate and pattern must be FMG, or building code approved to meet the intent of the wind uplift rating specified.

A. The Contractor shall determine fastener lengths,
   1. Minimum embedment:
      a. Steel: 3/4-inch
      b. Concrete/concrete block: 1-1/4 inch
      c. Gypsum: 2-inch,
      d. Tectum: 2-inch
      e. Wood: 1 1/4 inch.
   2. Fastener manufacturers: ITW Buildex, IWT Red Head, OMG and Tru-Fast or equal.
   3. All fasteners shall be corrosion resistant steel in accordance with ASTM F1667 or type 304 -316 stainless.

B. Summary of fasteners and requirements are as follows:
   1. Roofing and Other Nails: square or round head, ring shanked galvanized or non-ferrous type, length and diameter as required to suit application.
   2. Metal Counterflashing and other LG metal sheets to Wood: ITW Buildex, 'TruGrip, #9, self-piercing, corrosion resistance steel shank with EPDM washer.
   3. Metal Counterflashing and Other LG Sheet Metal [exposed] to Masonry: ITW Buildex, 1/4 inch, 'Scots Tapcon', stainless steel-hex head, ATF treads, corrosion resistant steel shank, with EPDM washer.
   4. Termination Bars [exposed] to Masonry: ITW Buildex, ¼ inch, 'Scots Tapcon', stainless steel-hex head, ATF treads, corrosion resistant steel shank, with EPDM washer.
   5. Metal Sheets or Metal Decking to Metal Decking: # 10 ITW Buildex,' tek/ 1', hex washer head, ATF self-tapping with corrosion resistant steel shank.
   6. Base Sheet, Cover Board, Membrane to Insulating Concrete, Gypsum or Wood Fiber Decking: Tru-Fast, Twin Loc-nail, Coated steel fastener assembled with a 2.7inch diameter coated plate with a stainless-steel locking staple.
   7. Insulation Fasteners/Plate, Wood Deck: Steel, HD #14, red, phillips head, superior corrosion resistance with a 3-inch round metal cap, meeting FMG 4470 standard requirements and must be supplied or approved by the roofing manufacturer for their warranty.
   8. Edge Securement [EPDM]: Reinforced perimeter fastening strip RTS, 6 in. wide, .045 in. thick, polyester scrim reinforced, with factory laminated self-adhering tape, fastened in place to the wall or the deck at 12 inches on center with manufacturer approved fasteners and plates.
   9. General Purpose Stainless Steel: Series 304 fasteners, with or w/out EPDM washers.

C. Summary of accessories items and requirements as follows:
   1. Pre-Molded Manufactured Accessories: Molded EDPM, color to match field, .050-.075 inch thick, pipe flashings, etc. Manufacturer warranted accessories.
   2. Walkway Pads: Non-Reinforced EPDM, 0.130 inches thick, size: 30-inch-wide x 40 feet long with patterned slip resistant bearing surface, self-adhered or factory applied tape.
   3. Roof Pavers: Refer to Section 07 76 10
   4. Termination Bars: Aluminum 1.3-inch-wide, 10 feet long, 1.08 inch [min.] thick bars with flat or with [integral caulk edge], as applicable per manufacturer.
   5. Pipe Supports/Hangers:
      f. Manufactured by Portable Pipe Hangers, Adjustable, stainless metal components, polypropylene base, 'type SS8 – C or R [up to 2 ½ inch pipes] or PP10' [up to 3 ½ inch pipes], as required for conditions.
      g. Manufactured by OMG, Pipe-Guard, non-adjustable, PGM-BK, PGS-BK, PGTS-BK pipes up to 2 inches, as required for conditions.

h. Manufactured by Advanced Supports Products, EcoCurb or MIRO pillow block. Pipe supports Condensate Lines/Piping.

6. Rail Curbs: Manufactured by Pate, type es-1, es-2 or es-5, as required for condition, size as required by unit base size including unit tie downs or as shown.
7. Vent Pipe Extenders: Manufactured by Tubos, Clearwater, FL, PVC pipe extenders.
8. A/C condenser and other roof top unit stands: Manufactured by Precision Aluminum Products, with height/load requirements provided including engineered tie downs and deck/substrate anchoring requirements.

2.6 SEALANTS/TAPES

A. General Use: ASTM C920, Type S, Grade NS, Class 25 as required for each joint condition, single component, elastomeric silicone polymer, non-staining, non-shrinking, non-sagging, and ultra-violet resistance, clear or to match surrounding existing color.
   1. Refer to section 079201 Sealants for Roofing.

PART 3 EXECUTION

3.1 EXAMINATION / LEVEL SURFACE CONDITIONS

A. Verify that surfaces and site conditions are ready to receive work. Verify that deck [total removed roofing membrane sections] is clean and smooth, free of depressions, irregularities, or projections, properly leveled, start of work constitutes acceptance of conditions.
   1. Verify that all wood blocking, nailers are securely anchored in place.

B. Areas of substrate where severe ponding [1inch deep or greater] will occur 48 hours after a rainfall with an outside average temperature of 65F or higher [partly sunny or sunny condition] shall be levered per manufacturers recommendation and identified to RDA prior to installing final membrane. Failure to perform this action could result in total roof removal at that ponding area, string leveling prior to final ply recommended.

3.2 PROTECTION

A. Protect building surfaces/interior spaces against damage from roofing work. It is the Contractor's responsibility to take any necessary actions to prevent construction-related leaks, to include but not limited to repairing watertight existing surrounding roofing scheduled to be replaced or overlaid. Surround roofing areas include roof top material storage areas, workers roof top access to from roofing work site areas and any drainage system [roof drain-scuppers] leak issues located in work area. Contractor must include the cost to deal with these existing leak sources into the overall project unless the Owner/Owners rep is made aware of these leak sources prior to commencement of the project.

B. Provide, erect barricades and guardrails as required by applicable regulatory advisory to protect occupants of building and workers.

C. Cover all drains and other openings intended for drainage during construction to prevent clogging of system, remove at the end of each day to allow for drainage.

D. Special precautions shall be taken to avoid fumes from entering the facilities through air intakes, coordinate with owner to deal with active A/C units.

3.3 INSULATION APPLICATION

General: Secure insulation to roof deck to the requirements of FMG loss Prevention Data Sheet 1-28 and 1-29 to include additional securement at the corners and perimeters. Install insulation including saddles [if required] as shown on the contractor/manufacturer-approved layout. This layout must be capable of draining the roof completely into drainage elements after 48 hours following rainfall with an outside average temperature of 65For higher [partly sunny or sunny conditions]. The layout pattern must not block the flow of rainwater into any roof top unit/ventilator.

A. Wood Deck: Fasten the insulation in a one-layer configuration onto the deck at the rate/pattern as tested/approved by the manufacturer and to meet FM requirements. All insulation shall be installed in accordance with the Manufacturer's / Contractors/ Architect approved layout. Install insulation with long joints in a straight line with end joints staggered. Install the insulation perpendicular to roof slope to the new insulation board with joints staggered [as applicable] no less than 24 inches in all directions from joints below in accordance with windstorm resistance classification securement pattern and insulation manufacturer's instructions. Any portion of an insulation board that falls within the calculated perimeter or corner area has the increased securement applied over the entire board. Offset joints of top insulation layers/cover board from bottom layers/saddles no less than 6 inches. Full tapered insulation system where tapered boards are on top require no offset.

B. Level all decks as necessary prior to starting work.

C. Apply no more insulation than can be sealed watertight with roofing membrane in the same day. Cut insulation to fit neatly to perimeter blocking and around penetrations through the roof, maximum joint width 3/8 inch.

D. All ventilators, A/C unit curbs, supports etc. [square or rectangle] will have a tapered edge strip [formed as a saddle] placed around the high side of unit to slope water from unit. Ventilators, A/C unit, supports etc. curbs over 2 feet wide will require insulation saddles sloped 1/2 inch per foot.

E. Provide adequate separation of insulation between hot exhaust stacks.

3.4 MEMBRANE APPLICATION

General: Install roofing sheets as per manufacturer's recommendations which may be slightly different than outlined due to weather conditions and the following summary of requirements. Only install membrane when outside temperature of 30-degree F or higher. Additional enhancements to the membrane will be required if a 30-year warranted system is specified herein, consult the manufacturer for these requirements. These requirements are in addition to what is specified herein.

A. Beginning at the low point of the roof, place the membrane without stretching over the acceptable substrate and allow membrane to relax a minimum of 30 minutes before attachment or splicing.

B. After making sure the sheet is placed in its final position seams shed water or parallel to the water flow, adjoin sheets in a manner that all lap seams along the length of the membrane overlap 3 inches for application of seam tape and 1 inch or butt at end laps. The membrane should be smooth, clean and free of wrinkles and buckles.

C. Starting from the center split of the exposed release liner, remove the release liner on one half of the sheet. Remove the liner on both sides at a 45-degree angle beyond the membrane edge. Pull the membrane onto the coverboard at an angle avoiding wrinkles and adhere it to the cover board. Do not fold the length of the roll in half. Keeping the membrane flat and secured and seams aligned continue removing the release liner. Removal of the liner should be accomplished by two people to use the slide out method or if cold condition exists use the barn door method. Fold back the remaining half of the sheet and repeat the process.

D. Use a stiff bristled broom and apply pressure to initiate adhesion and push air out from the sheet. Broom the installed membrane across the width working towards the outer edge. Use a 50-pound weighted roller to roll membrane after broom has been completed.

3.5 MEMBRANE SPLICING

[Factory Applied Tape] Position the sheet at the splice area by overlapping membrane. Tack the sheet back with primer at 5' centers and at factory splices or as necessary to hold back the membrane at the splicing area. Remove excess amounts of dusting agent on the sheet and at factory splices using a stiff push broom. Apply primer to both surfaces at the same time to allow the same flash off time. Additional scrubbing is required at areas that may have become contaminated or have excess amounts of dusting agent, and at all factory splices. Follow manufacturers guidelines if no factory tape is applied.

A. Position the seam splice tape on the bottom sheet, aligning the edge of the release paper with the markings. When adhering factory adhered tape, pull the backing from the tape and allow the top sheet to fall freely onto the exposed primed surface. Immediately roll the splice tape with a 3 inch-4-inch-wide silicone or silicone sleeved steel hand roller or a short nap 3-inch paint roller.

B. When the seam splice tape has been installed for the entire splice length, trim the top sheet as necessary to assure that 1/8 inch-1/2 inch of the seam splice tape will be exposed on the finished splice. Broom the entire length of the splice as the release paper is being removed.

C. Roll the splice using a 1-1/2 inch-2-inch-wide silicone or silicone sleeved steel hand roller, first across the splice, and then along the entire length of the splice.

3.6 FLASHING APPLICATIONS – Vertical Surfaces, etc.

General: Secure membrane when there is an angle change greater than 2 inch 12 inches with a reinforced perimeter fastening strip [RPS] fastened to the deck or wall, see manufacturer's recommendations for exceptions.

A. Remove loose or unsecured flashings, mineral surfaced or coated flashings and excessive asphalt to provide a smooth, sound surface for new flashings.

B. Apply primer to wall surface allow to dry. Roll the field EPDM membrane up the vertical surface evenly and carefully to minimize wrinkles.

C. Install T-Joint covers at field and other splice intersections as required by manufacturer. Apply tape at laps if membrane is not self-adhered type throughout out the sheet [edge to edge].

D. Provide termination directly to the vertical by a termination bar set in water block seal and other requirements as shown on the drawings.

3.7 FLASHING APPLICATION - Edge, Pipes and Drains.

General: Install flashing sheets over cants strips and other vertical surfaces, at edges and penetrations through roof as per manufacture's recommendations, requirements of FMG loss Prevention Data Sheet 1-49 including details and the following requirements**.**

A. EDGES
   1. Apply primer to the metal edging and membrane. Remove approximately 2 ft.-3 ft. of release paper from the seam flashing and apply to the metal flange and membrane. Lap adjacent rolls of seam flashing a minimum of one inch with a 2 inch-3-inch-wide silicone or silicone sleeved steel hand roller, roll the seam flashing ensure proper adhesion. Additional attention must be given to factory splice intersections and to any change in plane.

2. Apply 6-inch length of seam flashing, a seam Joint Cover, or 6-inch x 6-inch form flash to the inside edge of the seam flashing at all overlaps and at all intersections between the seam flashing and field fabricated splices.
3. Apply seam edge treatment at the intersections of the flashing sections.
4. If the roof edge includes a metal edge and sealant is not applied between the laps in the metal edging, an additional piece of seam flashing shall be applied over the metal lap to the top of the metal edge, after the initial application of seam flashing. Seam edge treatment shall be applied at the intersections of the two flashing sections.

B. PIPES
1. Flash pipes with manufactures pre-molded flashing to max. extent possible or form flash only when per-molded flashing is not available. Prime and install an additional 12-inch seam flashing over pre-molded flange.

C. DRAINS
1. Remove all existing flashings, leads and cement. Provide a clean even finish between the drain clamping ring and the drain bowl. Position the membrane and cut a hole for the roof drain allowing a ¾ inch membrane inside the clamping ring. Make round holes in the membrane to align with the bolts. Install water block seal on the clamping ring flange below the membrane. Tighten the clamping bolts to achieve a constant compression. Replace or repair [bolts broken, cannot be removed] drain where existing clamping ring cannot be bolted securely in place.

3.8 LIQUID FLASHING

A. Liquid flashing [LF] system [PMA] shall be installed on a clean roof surface with a reinforced polyester fleece fabric in a multi-layer [resin/fleece/resin] configuration with PMA resin applied [fully saturating fabric] at 2 gallons per square feet with resin top coat, Extending vertically and 8 beyond the base of penetration. LF shall be installed where noted or as required by condition per the manufacturer. Install in accordance with manufacturer's printed detail or as shown.

3.9 INSTALLATION OF ROOF ACCESSORIES

A. Walkway pads and other accessories shall be installed in accordance with the manufacturer's recommendations or as shown on the drawings. Space pads 3 inches apart.

B. Expansion joint, and other accessories not noted herein shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings.

C. Rail curbs, equipment stands, and pipe supports shall be installed in accordance with the manufacturer's instructions. Anchoring to substrate and tie downs as shown. Place curbs on deck and position curbs ends to allow water to flow toward drains or gutters.

D. Equipment enclosure shall be 24-gauge stainless steel, shop or pre-manufactured with top fabricated [angled] to allow no moisture from entering the pipe areas. Install mortar in the bottom of base with polyurethane pourable sealer poured around pipes [2-inch depth minimum]. Seal pipes that exit enclosure with sealant/foam.

E. Penetration pans shall have mortar installed in the bottom of pitch pans with polyurethane pourable sealer [2-inch min] filled to the top of the pan, then slope.

F. Roof drain clamp rings/bolts where distorted, corroded or to short, shall be replaced. Clamp rings shall be clean of all asphalt and other deposits. Provide new drain strainers where missing. Install drain inserts if clamping rings cannot be compressed on the new roof membrane due to broken bolts, etc.

G. A/C condenser and other roof top unit stands shall be installed in accordance with engineered requirements furnished by the manufacturer to include height/load, tie downs and deck/substrate anchoring requirements.

3.10 FIRE SAFETY

A. Measures to be implemented by the contractor to minimize the possibility of fire and to provide a safe work environment. It is the responsibility of the contractor performing any work to comply with the safety provisions of the National Fire Codes pertaining to such work along with other requirements specified herein. In the event of a fire of any size, Contractor shall notify the Local Fire Department.

3.11 WATER CUT-OFF

A. At the end of the day's work or when precipitation is imminent, a water cut-off or other waterproof protection shall be provided to ensure a watertight condition is obtained, between the new and existing conditions, remove cut-off prior to resuming the installation of the roofing system.

B. Contractor is responsible for the design and implementation of the night seal / water cut-off. Provide plan / implementation to Architect / Owner for review.

3.12 CLEANING

A. In areas where finished surfaces are soiled by any other source of soiling caused by work of this section, consult manufacturer for cleaning advice.

END OF SECTION

SECTIONS 07 62 00 - SHEET METAL FLASHING, TRIM AND SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDES BUT NOT LIMITED TO:

General: Intent of project is to provide new sheet metal components for a new roof replacement. Install all components, including sheet metal items, accessories of the new roof system needed for a completed watertight installation.

A. Removal of existing sheet metal items as noted. Refer to section 07 01 50 Preparation for Reroofing.

B. Installation of new sheet metal items:
1. Wind-rated coping, fascia/cover and edge, ANSI/SPRI/FM ES 1, tested and approved.
2. Sheet metal fasteners.
3. Skirt / Bib flashing [around units and curbs], counter flashing, and other sheet metal items.
4. Thru wall scuppers, conductor heads, and downspouts.
5. Equipment support flashings.
6. Equipment enclosures

1.2 APPLICABLE REFERENCES

General: The following references form a part of this specification.
1. ASTM A 653 Metallic Coated, Sheet Steel [Galvanized], Grade A, Hot Dipped, Zinc Coated, Coating Class G90.
2. ASTM A 792, Metallic Coated, Sheet Steel [Galvalume], Grade 40, Coating Class A250 [Galvalume] Zinc Alloy.
3. ASTM A 755, Pre-Finished, Sheet Steel [Galvanized/Galvalume], Grade 40, Coating Class A250 or G90, Pre-painted by the coil coating process.
4. ASTM B 209, Aluminum.
5. ASTM D 1970 Self-Adhered Membrane
6. ASTM E 108 Fire Test of Roof Coverings.
7. ASTM E 2112 Installation of Exterior Door Flashings.
8. [FMG] Factory Mutual Global - Current Approval System [NAV assembly numbers], Loss Prevention Data Sheets for Roof Deck Securement for Above Deck Roof Components, Perimeter Flashings, Wind Design-ANSI/FM 4474, Approval Standards for Roof Materials FM 4470 and Roof Loads for Construction
9. [UL] Underwriters Laboratories - Roofing Materials and Systems Directory, Fire Resistance Directory, Current Edition.
10. [NRCA] National Roofing Contractors Association - Current Roofing and Waterproofing Manual, including shop fabricated metal edge testing.
11. [AISC] Manual of Steel Construction
12. [SMACNA] Sheet Metal and Air Conditioning Contractors Association-Current Manual.
13. [OSHA] Occupational Safety and Health Administration, Guidelines
14. [ASCE/SEI] 7-16 Minimum Design Loads for Buildings
15. [ANSI/SPRI/FM 4435] standard ES-1-17 Wind Design for Edge Systems
16. [NFPA] National Fire Protection Association, 58 Liquefied Petroleum Gas Code
17. [ANSI/SPRI] WD-1 Wind Design Standards.

1.3 QUALITY ASSURANCE

A. Fabricator/Installer: Company specializing with skilled workers in sheet metal with minimum 5 years documented experience, never been terminated by a manufacturer for workmanship problems and be capable of providing the warranties as specified.

B. Sheet Metal items and installation shall comply with SMACNA's [Architectural Sheet Metal] and NRCA's [Roofing] current manuals.

1.4 COORDINATION

A. Coordinate sheet metal flashing, trim layout installation with adjoining roofing to provide a leakproof, secure non-corrosive installation.

1.5 PERFORMANCE REQUIREMENTS

A. Fire Hazard Classification: Underwriters Laboratories [UL], Use only Class A fire-rated materials as tested in accordance with ASTM E 108 or UL 790 for exterior fire.

B. Install sheet metal items to withstand wind loads, structural movement, by preventing buckling, opening of joints, hole elongation, failure of joint sealant, failure of connections and other detrimental effects.

C. All perimeter metal items [copings and edges] must have been tested to resist the wind design loads for the building.

1.6 DELIVERY, STORAGE and HANDLING

A. Do not overload the structure with storage of materials; verify roof deck weight capacity and location of structural supports, only items needed that day shall be stored on the roof. Limit loads on roof to 25 pounds per square foot for uniformly distributed loads for metal / wood decks, 75 pounds per square foot for uniformly distributed loads for concrete decks. Store and protect products in accordance with manufacturer's instructions.

B. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact. Protect sheet metal items during transportation and handling.

C. Store products in weather-protected environment [manufacturer's plastic wrap is accepted for proper protection, unless wrap is broken, torn or removed], clear of ground 4 inches minimum and protected from exposure from direct sunlight. Use breathable tarps for moisture protection as needed. Damaged materials will be marked 'rejected' by the Contractor / Owner or Architect and removed from the site.

D. Storage of flammable liquids in buildings is prohibited. All combustible debris shall be removed from the site daily.

1.7 WEATHER CONDITIONS

A. Do not apply materials during inclement weather, high winds or when the chance of rain is 60% or greater, percentage as listed on www: weather.com for the local area, percentage as listed when read at 7 AM local time or at time of work commencement.

1.8 SEQUENCING and SCHEDULING

A. Building space underneath roof work is utilized by on-going operations. Coordinate all work with Owner including, material storage, scaffolding [as required] and contractor parking. Owner's approval required before proceeding with the work. **Contractor must provide overhead protection for owner's workers from falling materials/debris at building entry points.**

1.9 MANUFACTURERS WARRANTIES

A. Provide a manufacturer's warranty for both repairs/replacements due to any faults in the material and workmanship. Any repairs/replacement due to normal wear and tear, material finish defects and workmanship defects.
   1. Sheet metal items shall be warranted watertight for [20] twenty years by the roof membrane manufacturer.

2. Sheet metal manufacturer of record must provide a [20] twenty-year finish warranty for the metal fascia, coping and edge as outlined herein, Warranty shall cover finish fading, chalking, cracking, peeling or failure of paint to adhere to the base metal. The warranty shall be a lifetime warranty for defects of material or failure to resist wind speeds as outlined.
3. Sheet metal coping and roof edges that terminate into/attach to [incorporated] into the roof membrane shall be warranted for winds up to 120 MPH or higher by the roof membrane manufacturer [part of the roof warranty] or by the metal manufacturer. Pre-manufactured items regardless of their location must be warranted and be tested by the metal manufacturer to resist failure [blow off] for wind speeds up to *120* mph and be certified to meet or exceed the design pressure as stated herein. The installation of these items must be incompliance with the metal manufacturers installation requirements and field condition attachments guidelines and as shown. The roof manufacturer can incorporate this warranty requirement into their roof warranty if approved by their metal manufacturer/fabricator.

B. In the event of a default by the contractor, the manufacturer will provide a new contractor to fulfill the warranty obligation.

1.10 PORTABLE FIRE EXTINGUISHERS

A. Two standard listed multipurpose dry chemical fire extinguisher, NFPA 10, with 10-pound capacity, 4A-60B:C UL rating shall be provided and located near the work area. Additional fire extinguishers shall be provided for different roof levels/work sites [see general requirements]. Contractor to ensure all personnel are trained to use fire extinguishers.

1.11 DEFINITIONS

A. Shop fabricated includes items that will be formed at the fabricators shop predominately by press brake. Prefabricated or manufactured items will be plant manufactured ready for installation and wind rated in compliance with ANSI/SPRI ES-1.

PART 2 - PRODUCTS

General: All products shall be Building Code approved as applicable**.**

2.1 FABRICATION

A. Fabricate sheet metal items to comply with recommendations in SMACNA [architectural Sheet metal manual] and NRCA's [the NRCA roofing manual]. Conceal fasteners and expansion provisions where possible on exposed to view items. Provide expansion provisions as recommended where lapped or bayonet type expansion cannot be used.

2.2 FASTENERS/SPECIALTY ITEMS

General: Fasteners/Anchors: strength, type and configuration must meet the required pull test resistance for each attachment application. Fastener rate and pattern must be Factory Mutual or local code approved to meet the intent of the wind uplift rating specified.

A. The Contractor shall determine fastener lengths,
   1. Minimum embedment:
      a. Steel: 3/4-inch
      b. Concrete/concrete block: 1-1/4 inch
      c. Gypsum: 2-inch,
      d. Tectum: 2-inch
      e. Wood: 1 1/4 inch.
   2. Fastener manufacturers: ITW Buildex, IWT Red Head, OMG and Tru-Fast or equal.
   3. All fasteners shall be corrosion resistant steel in accordance with ASTM F1667 or type 304 -316 stainless.

B. Summary of fasteners and requirements are as follows, see roofing section:
   1. Metal Counterflashing and other LG metal sheets to Wood, ITW Buildex, 'tru-grip', self-piercing, # 9 – 11/64-inch diameter, corrosion resistance steel shank with EPDM washer, if applicable.
   2. Metal Counterflashing and Other LG Sheet Metal [exposed] to Masonry, ITW Red Head, 1/4-inch diameter, 'Scots Tapcon', stainless steel-hex head, HL treads, corrosion resistant steel shank, with EPDM washer.
   3. General Purpose Stainless Steel: Series 304 fasteners, with or w/out EPDM washers as required.

C. Summary of specialty items and requirements as follows:
   General: Sheet Metal Items: All metal components not incorporated into the roof system and not outlined herein or shown on the drawings shall be fabricated with *.032-inch-thick pre-finished aluminum or 24-gauge stainless steel unless otherwise noted.*
   1. Penetration Pockets: 24-gauge stainless steel, soldered together with 4-inch roof flange and 4-inch height or size required for condition, only use if another manufacturer approved detail, field flashing, or liquid flashing system will not work for the conditions.
   2. Continuous Cleats: Galvanized steel, 22 gauge.
   3. Counterflashing: 24 gauge pre-finished metal, fabricated in lengths maximum 12 feet, designed to be removable. Counter flashing to be notched and lapped at inside corners and joints.
   4. Equipment Enclosure shall be 24-gauge galvanized metal, shop or pre-manufactured with top fabricated [angled] to allow no moisture from entering the pipe areas, access to pipes required. Solder all corners, as applicable. Install spray-in foam insulation around the pipes to seal watertight.
   5. Coping, Wind-Rated [pre-manufactured/ES-1 shop fabricated]: pre-finished, 22 or 24 gauge pre-finished metal coping cap as shown, without exposed fasteners cleated on both sides, [continuous cleated or anchor clips configuration cleats] tapered style [toward roof], butt joint. Provide factory-fabricated corners and intersections. Concealed 8-inch-wide splice plates which must allow the cap to expand and contract freely while locked in place, continuous cleats or with a heavy gage metal anchor clips [12 inches wide] anchored to nailer/substrate in accordance with print approvals [maximum spacing three feet on center-two feet in corners]. Size and shape as shown or to match existing wall width, roof membrane manufacturer approved and warranted to meet or exceed design pressures/winds speeds [see manufacturer's warranties]. 20-year leak proof warranty by the roof membrane manufacturer and 20-year finish warranty by the metal manufacturer. Copings shall be ANSI/SPRI/FM 4435 ES-1-17 tested and approved for winds speeds up to *120 MPH* or higher. Pre-Manufactured by Metal Era's 'Perma-Tite tapered Coping or roof manufacturers equivalent.
   6. Drip Edge or Fascia, Wind-Rated [pre-manufactured/shop ES 1 fabricated] – face over 2 1/2 inches long: pre-finished 24 gauge pre-finished metal drip cover over extruded anchor bar, fastened to wood nailer with #10 screws, continuous cleated. Size, length, profile as shown, roof membrane manufacturer approved and warranted to meet or exceed design pressures/winds [see wind warranty] and 20-year finish warranty by the metal manufacturer. ANSI/SPRI/FM 4435 standard ES-1-17 and tested and approved for winds up to *120 MPH* or higher. Pre-Manufactured by Metal Era's, Anchor Tite System [drip or fascia] or roof manufacturer's equivalent.
   7. Drip Edge [shop fabricated-not wind rated] - face under 2 1/2 inches: Does not require a cleat and shall be fabricated with 24 gauge, pre-finished metal.
   8. Scupper Lining: 24-gauge, stainless steel, solder all corners, size and shape as required or shown. Installation [SMACNA FIG.1-30A similar-see drawing].
   9. Skirt [bib] Flashing Metal: 24-gauge stainless steel or pre-finished 24 gauge metal, minimum 4 inch wide. Use stainless steel screws for anchoring.

10. Conductor Head: 24 gauge pre-finished metal, pop riveted and sealed, [SMACNA, style FIG 1-25F], top opening size as existing with other dimensions in accordance with SMACNA sizing recommendations or as required by condition.
11. Downspouts: 24 gauge pre-finished metal, rectangular shape, smooth with flat lock seams, complete with mitered elbows / offsets as required, size 3-inch x 4-inch, unless otherwise noted, see roof plan for locations.
12. Downspout Hangers: 1 inch wide, 1/16-inch thick pre-finished metal [primed and painted] to match downspout color [SMACNA Fig 1-35A]. Install hanger at 10 foot on center maximum intervals. Coordinate placement with building lines and offsets as required.

2.3 SHEET METAL

General: Roof membrane manufacturer supplied and approved components [copings/roof edges - as required/shown] must be used, these sheet metal components must be pre-manufactured and be tested and approved in accordance with ANSI/SPRI/FM 4435/ES-1 test method standard and must be included into the roof warranty [as outlined]. Fabricated by Metal Panel System, Architectural Products, Metal Era, Pac-Clad Peterson, Una-Clad, Drexel Metals or Dimensional Metals, etc. *Some wind rated items may be shop fabricated, if pre-manufactured item is not currently available [a metal fabricator [see above] and roofing material manufacturer may allow the roofing contractor to use their metal/materials/installation methods and shop fabricate and install the items in accordance with their wind rated ANSI/SPRI/FM 4435-ES-1 standard approved tested requirements.] This will only be accepted if the contractor is an NRCA approved installer for ES-1 tested products and the item will comply/match Architect's detail [size/gauge/installation method] and an ES-1 current product certification is provided for each item. In all cases, the roof material manufacturer must approve/warrant the sheet metal items in accordance with meeting/exceeding the wind resistance requirements and finish warranties as outline herein and any other design requirements].* All other metal shall be shop fabricated in accordance with SMACNA 6th Edition or other details or pre-manufactured as shown.

A. Pre-Finished Sheet Steel [Galvalume]: ASTM A792, grade 40, class A250, 24 or 22 gauge [as noted], primed and repainted by coil coating, finished exposed to view side with a fluoropolymer Kynar 500 [PVDF] thermally cured coating and a wash coat .5 mil thick applied to the reverse side; 20-year warranty covering fade, chalking and film integrity. Colors as selected by Owner.

B. Pre-Finished Sheet Steel [Galvanized]: ASTM A755/A653, G90, 24 or 22 gauge [as noted], primed and repainted by coil coating, finished exposed to view side with a fluoropolymer Kynar 500 [PVDF] coating and a wash coat .5 mil thick applied to the reverse side; 20-year warranty covering fade, chalking and film integrity. Colors as selected by Owner.

C. Pre-Finished Aluminum: ASTM B209, 3105 H15 alloy, thickness .032, .040 or .50 inches [as noted], primed and repainted by the coil coating, finished exposed to view side with a fluoropolymer kynar 500 [PVDF] thermally cured coating and a wash coat 0.5 mil thick applied to the reverse side; 20-year warranty covering fade, chalking and film integrity. Colors as selected by the Owner.

D. Galvanized Sheet Steel: ASTM A653, hot dipped, zinc coated, G90, gauges as shown.

E. Stainless Steel: ASTM A240/A 240M, dead soft fully annealed, smooth 24-gauge, Type/Grade 304 [painted or not] and 316 [exposed to view].

2.4 SEALANTS/TAPES

General Use: Provide joint sealants for sheet metal, backing and other materials as required to seal joint that are compatible with each other based upon industry test and field experience.

A. ASTM C920, Type, Grade, Class as required to seal joints, single component, elastomeric silicone polymer, non- staining, non-shrinking, non-sagging and ultra-violet resistant, clear or to match surrounding existing color.

1. Refer to section 079201.

B. Gutter: GE Silicone II, clear in color, or approved equal.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release paper.

PART 3 - EXECUTION

3.1 EXAMINATION and CONDITIONS

A. Verify that surfaces and site conditions are ready to receive work.

3.2 PROTECTION

A. Protect building surfaces/interior spaces against damage from work.

B. Provide, erect barricades and guardrails as required by applicable regulatory advisory to protect occupants of building and workers.

3.3 INSTALLATION OF SHEET METAL AND SPECIALTY ITEMS

General: Sheet metal items shall be installed in accordance with **manufacturer's and NRCA's/SMACNA** recommendations and details from their current manual. Anchor sheet metal items securely in place with provisions for expansion. Use items as required to complete the sheet metal or drainage system. Where dissimilar metals contact each other, protect against galvanic action by coating material as recommended by the fabricator. Seal joints with sealant as required for a watertight condition.

A. Continuous cleat [for non-pre-manufactured metal components]: Cleats shall not exceed 12 feet in length; allow a 1/4 inch gap between pieces. Fasten cleat to wood nailer top as applicable at 4 inches on center [staggered pattern-1 inch from edge] with corrosion resistant annular threaded nails [3/16-inch head], long enough to penetrate the wood 1-1/4 inch.

B. Penetration pans shall have mortar installed in the bottom of pitch pans with polyurethane pourable sealer [2-inch depth minimum] filled to the top of the pan, then slope.

C. Skirt [Bib] flashing shall be installed around all roof top units/supports and all items that cannot be removed and reinstalled. Position under unit curb and anchor to unit with corrosion resistance fasteners with EPDM washers at 12 inches on center unless otherwise noted.

D. Equipment enclosure shall have mortar installed in the bottom with polyurethane pourable sealer [2-inch depth minimum] filled. Seal pipes that exit enclosure with sealant/foam.

E. Termination bars shall be placed no more than 1-1/2 inches down from the top of the base flashing and be fastened at 6 inches on center with concrete self-tapping [tapcon] or wood fasteners, as applicable, fitted with an EPDM washer. Provide sealant at the top edge of bars.

F. Counterflashing [CF] shall be surfaced mounted [SM] or in existing or new reglets/receivers with lap joints 4 inches. Attach SM with concrete self-tapping [tapcon] or wood fasteners, as applicable fitted with an EPDM washer at 12 inches on center, 1-inch minimum embedment. Apply a bead of sealant on the top of 45% angle lip of the metal flashing if SM type. CF shall overlap base flashing a minimum of three inches, fit tightly to base flashing and shall terminate no lower than 4 inch above finished roof surface, unless approved by the manufacturer.

G. Wind Rated ES-1 approved coping sections shall be jointed together with a butt type joint with 8-inch-wide concealed splice located underneath the 10 to 12-foot-long panels, which must allow to expand and contract freely while locked in place. Provide factory-fabricated corners, intersections and ends. Coping metal anchor clips to be anchored to wood nailer or surface material at splice joints and within the coping panel [approx. every three feet on center-2 feet in corners.] or coping that is installed using continuous cleats on both sides shall have cleats anchored on top of nailer at 12 inches on center. Provide self-adhered or adhered 60 mil thick

EPDM over nailers/substrate to allow moisture to drain off edges without moisture to enter wall under coping cap [provide non-curing dual sealant strips on each side of splice plates], ensure EPDM membrane covers all wood nailers/substrate. Both methods shall use stainless steel fasteners or other fasteners to meet the wind resistance pressures as shown and as recommended by coping manufacturer **printed approvals**. Coping shall have a 4-inch vertical end flange where terminating into wall, counter-flash flanges.

H. Wind Rated, ANSI/SPRI/FM 4435/ES-1 approved roof fascia/drip shall have an extruded anchor bar, face fastened as outlined per the metal manufacturer, 12 inches on center to the nailer with 2-inch-long #10 stainless steel fasteners with the roofing membrane extending under the anchor bar and down face of nailer or wall surface. Fascia/drip cover plate shall be cleated and snapped in place with no exposed fasteners. The formed roof flange/cover plate shall be set in approved sealant/mastic on finished roof surface with the written manufacturer's guidelines. Edge face shall exceed down to overlap and cover nailers onto exterior wall minimum 2 inches or existing metal fascia as shown. Follow manufacturer installation instructions.

I. Conductor heads shall be installed in accordance with Fig 1-25 F SMACNA. Set top of conductor head at 1 inch below scupper to permit overflow. Provide extended face plate around scupper opening as required to cover old profile.

J. Downspouts shall be attached to the conductor with screws. Attach downspout sections to wall with 1-inch-wide, 1/16-inch steel straps [2 per 10-foot section] - Fig 1-35 A SMACNA, with stainless steel screws anchored into solid support members. Down spouts terminating at ground or roof shall be provided with an elbow fitting and a concrete splash block [provide a roof membrane sheet under blocks that terminate on the roof]. If existing receivers are available or new undergrade piping is installed, downspouts shall be inserted into receivers, provide size and shape adapters as necessary.

K. Drip edge [face under 2-1/2 inches in length]. Anchor roof flange onto wood nailers with screws or nails driven flush at 4 inches on center, staggered. Drip edge face to extend into gutter or overlap fascia board minimum 3 inches.

3.4 CLEANING

A. In areas where finished surfaces are soiled by any other source of soiling caused by work of this section, consult manufacturer for cleaning advice.

END OF SECTION

SECTION 07 62 10 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 WORK INCLUDES

A. Installation of new sheet metal flashings and counterflashings for siding / building enclosure components, except for roof related components [Refer to Section 07 62 00].

1.2 SYSTEM DESCRIPTION

A. Sheet Metal System: Conform to criteria of [SMACNA "Architectural Sheet Metal Manual."]

1.3 SUBMITTALS

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, termination, and installation details.

1.4 COORDINATION

A. Coordinate sheet metal flashing, trim layout installation with adjoining building enclosure components such as siding, trim, openings, penetrations, etc. to provide a leakproof, secure non-corrosive installation.

1.5 PERFORMANCE REQUIREMENTS

A. Fire Hazard Classification: Underwriters Laboratories [UL], Use only Class A fire-rated materials as tested in accordance with ASTM E 108 or UL 790 for exterior fire.

B. Install sheet metal items to withstand wind loads, structural movement, by preventing buckling, opening of joints, hole elongation, failure of joint sealant, failure of connections and other detrimental effects.

1.6 DELIVERY, STORAGE and HANDLING

A. Do not overload the structure with storage of materials; verify roof deck weight capacity and location of structural supports, only items needed that day shall be stored on the roof. Limit loads on roof to 25 pounds per square foot for uniformly distributed loads for metal / wood decks, 75 pounds per square foot for uniformly distributed loads for concrete decks. Store and protect products in accordance with manufacturer’s instructions.

B. Deliver products in manufacturer’s original containers, dry, undamaged, with seals and labels intact. Protect sheet metal items during transportation and handling.

C. Store products in weather-protected environment [manufacturer’s plastic wrap is accepted for proper protection, unless wrap is broken, torn or removed], clear of ground 4 inches minimum and protected from exposure from direct sunlight. Use breathable tarps for moisture protection as needed. Damaged materials will be marked ‘rejected’ by the Contractor / Owner or Architect and removed from the site.

D. Storage of flammable liquids in buildings is prohibited. All combustible debris shall be removed from the site daily.

1.7 SEQUENCING and SCHEDULING

A. Building space underneath roof work is utilized by on-going operations. Coordinate all work with Owner including, material storage, scaffolding [as required] and contractor parking. Owner’s approval required before proceeding with the work. **Contractor must provide overhead protection for owner’s workers from falling materials/debris at building entry points.**

1.8 DEFINITIONS

A. Shop fabricated includes items that will be formed at the fabricators shop predominately by press brake.

1.9 WARRANTY

A. Furnish lifetime limited year manufacturer warranty for finishes.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

A. Pre-Finished Aluminum Sheet: ASTM B209; 3003 alloy, H15 alloy; mill finish shop pre-coated with acrylic color as selected from full range of manufacturer's standard colors.
   1. 20 gauge [0.032 inch thick] cladding / flashings where intended to be left exposed [including all fascia and rake, trim cladding, etc]. Alternate: install 24 gauge pre-finished metal cladding where needed / outlined on drawings. Coordinate with Section 07 62 00.
   2. 24 gauge [0.020 inch thick] or 26 gauge [0.016 inch thick] flashings at starter strips, concealed flashings, etc.

B. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M; grade A; structural steel sheet, G90 (Z275) zinc coating; 24 gauge steel, shop pre-coated with two coat fluoropolymer top coat [Kynar 500, 70% formulation]; color as selected from full range of manufacturer's standard colors.

2.2 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers as required to suit conditions.

B. Underlayment: ASTM D226; Type I, No. 15 unperforated asphalt felt.

C. Protective Backing Paint: Bituminous.

D. Slip Sheet: Rosin sized building paper.

E. Sealant: Exterior metal lap joint butyl or polyisobutylene sealant as specified in Section 07 90 00.

F. Plastic Cement: ASTM D4586, Type I.

G. Reglets: As required to suit conditions.

H. Primer and Solvent for Polyvinyl Chloride (PVC): As recommended by manufacturer.

2.3 FABRICATION

A. Fabricate sheet metal items to comply with recommendations in SMACNA [architectural Sheet metal manual], NRCA’s [the NRCA roofing manual], and siding manufacturer details. Conceal fasteners and expansion provisions where possible on exposed to view items. Provide expansion provisions as recommended where lapped or bayonet type expansion cannot be used.

B. Form components to shape indicated on Drawings, accurate in size, square, and free from distortion or defects. Form pieces in longest practical lengths.

C. Fabricate cleats and starter strips of same material as sheet, to interlock with sheet.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

E. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.

F. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

G. Fabricate corners in one piece, 18 inch long legs; seam for rigidity, seal with sealant.

2.4 SHOP FINISHING

A. Acrylic coating: Baked enamel system conforming to AAMA 2603.

B. PVDF (polyvinylidene fluoride) coating: Multiple coats, thermally cured, fluoropolymer system conforming to AAMA 2604 or AAMA 2605. (KYNAR 500)

C. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION

A. Install starter and edge strips, and cleats.

B. Install surface mounted reglets. Seal top of reglets with sealant. Insert flashings to form tight fit. Seal flashings into reglets with sealant.

C. Secure flashings in place using [concealed] fasteners.

D. Install cladding over existing / new wood substrate. Brake form to profiles required in the longest lengths practical. Hang to minimize oil canning and other unintended movement / twisting, etc. Allow for expansion and contraction.

E. Apply plastic cement compound between metal work and felt flashings.

F. Fit components tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

G. Seal joints watertight.

END OF SECTION

SECTION 07 76 10 – RUBBER PAVING TILES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes resilient, interlocking, architectural rubber paving tiles.

1.2 SUBMITTALS

A. Product Data: Submit data indicating materials, component profiles, jointing details, sizes, surface texture, finishes / colors, and accessories.

B. Samples: Submit two samples illustrating surface texture and color.

1.3 REFERENCES

A. ASTM C 67 – Standard Test Method Methods for Sampling and Testing Brick and Structural Clay Tile.

B. ASTM D 395 – Standard Test Methods for Rubber Property–Compression Set.

C. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers–Tension.

D. ASTM D 573 – Standard Test Method for Rubber-Deterioration in an Air Oven.

E. ASTM D 624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

F. ASTM D 1667 – Standard Specification for Flexible Cellular Materials, Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).

G. ASTM D 2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.

H. ASTM D 2859 – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

I. ASTM E 108 – Standard Test Methods for Fire Tests of Roof Coverings.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of 5 years experience for the manufacturing of rubber paving tiles similar to those specified.

B. Installer Qualifications: Minimum of 3 years' experience with installation of similar products.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Remodel mock-up area as required to produce acceptable work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation in accordance with manufacturer's instructions.

B. Handle products to prevent damage.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Tile Temperature: Ensure surface temperature of rubber paving tiles is a minimum of 40 degrees F at the time of installation.

B. Air Temperature: Ensure ambient air temperature is a minimum of 40 degrees F for a minimum of 24 hours prior to and at the time of installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Limited lifetime product warranty against manufacturing defects, non pro-rated

PART 2 PRODUCTS

2.1 RUBBER PAVING TILES

A. Description: Resilient, interlocking, architectural rubber paving and ballast tiles.
   1. Basis of Design: DuraSTRONG Rubber Paving Tiles, Plus Series, or Equal.

B. Material: Compression-molded, recycled rubber and binding agents.

C. Tile Locking: U-shaped male and female locking mechanism on all 4 sides of the tile to support tile-to-tile adhesion while ensuring tiles are held in place.

D. Top Edges: Chamfered.

E. Tile Sides: edge-cut system for maximum seam adhesion.

F. Wear Layer: compression molded to obtain optimum density and durability. Combination of elongated SBR rubber and granulated crumb rubber. Pigmented to achieve color.

G. Size: 24” x 24” nominal size.

H. Thickness: 2-inches.

I. Weight: 24 pounds.

J. Color: As selected from the full range of available colors.

K. Testing
   1. Freeze Thaw, ASTM C 67: No deterioration.
   2. Rubber Deterioration/Air Oven, ASTM D 573: No deterioration.
   3. Slip Resistance:
      a. ASTM E 303: Dry: 51 minimum; Wet: 44 minimum.
      b. ASTM D 2047: 0.533.
   4. Tensile Strength, ASTM D 412: 0.661 Mpa
   5. Elongation at Break, ASTM D 412: 68.5 percent
   6. Tear Strength, ASTM D 624: 2.2 kNm
   7. Flammability, Burning Pill, ASTM D 2859 – Pass
   8. Density, ASTM D 3676: 817 kg/m3
   9. Taber Abrasion, Wear Index, ASTM C 501: 205.

2.2 ACCESSORIES

A. Corners:
   1. Prefabricated outside and inside corners.
   2. Material: Same as rubber paving tiles.

B. Adhesive:
   1. Approved and furnished by manufacturer.
   2. Single-component, 100% solids, polyurethane.
   3. Waterproof and supplied in tube format.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive rubber paving tiles. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 PREPARATION

A. Prepare subsurface in accordance with manufacturer's instructions to ensure proper slope, support and drainage for rubber paving tiles.

B. Ensure existing sub-surface is clean and sound with no cracks or loose material.

C. Do not damage EPDM roof membrane during installation.

3.3 INSTALLATION

A. Install rubber paving tiles in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Apply adhesive in accordance with manufacturer’s instructions for tile-to-tile installation.

C. Cut rubber paving tiles to fit around fixed obstacles.

D. Install additional rubber paving tiles securement at perimeter in accordance with manufacturer’s instructions.

3.4 CLEANING

A. Remove adhesive spills from rubber paving tiles in accordance with manufacturer's instructions.

B. Clean rubber paving tiles in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect completed tiles from damage during construction.

B. Protect rubber paving tiles from foot traffic for a minimum of 12 hours after installation.

END OF SECTION

SECTION 07 90 00 - JOINT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes sealants and joint backing.

1.2 SUBMITTALS

A. Product Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.4 QUALITY ASSURANCE

A. Sealant shall be installed by a qualified sealant applicator for any/all joint sealant exposed to view. Owner reserves the right to request a mockup of the quality for the joint sealant installation.

PART 2 PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
   1. Tremco [basis of design]
   2. Sika
   3. GE Silicones.
   4. Pecora Corp.
   5. DAP

B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Liquid-Applied Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

E. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Additional Movement Capability: Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

G. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range, unless otherwise noted.

2.2 SILICONE JOINT SEALANTS:

A. **Type S-1**: Single component, nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, Use NT

1. Tremco Spectrem 1 or Spectrem 800 or Equal

B. **Type S-2**: Single Component, nonsag, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, use NT
   1. Tremco Spectrem 2 or Spectrem 3 or Equal

C. **Type S-3**: Multi-Component, Nonsag, Silicone Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, Use NT
   1. Tremco Spectrem 4-TS or Equal

D. **Type S-4**: Single Component, nonsag, Traffic-Grade, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, Use T
   1. Tremco Spectrem 800 or Equal

E. **Type S-5**: Mildew Resistant, Single Component, Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT
   1. Tremco Tremsil 200 Sanitary or Equal

2.3 URETHANE JOINT SEALANTS

A. **Type U-1**: Single Component, nonsag, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25 or 35, Use NT:
   1. Tremco Dymonic or Dymonic FC or Equal

B. **Type U-2**: Single Component, nonsag, Traffic Grade, Urethane Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use T.
   1. Tremco Vulkem 116 or Equal.

C. **Type U-3**: Multi-Component, nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, Use T.
   1. Tremco Dymeric 240 or Dymeric 240 FC or Equal

D. **Type U-4**: Multi-Component, nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, Use NT.
   1. Tremco Vulken 227 or Equal

E. **Type U-5**: Multi-Component, nonsag, Traffic Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, Use T.
   1. Tremco Vulken 227 or Equal

2.4 BUTYL JOINT SEALANTS

A. **Type B-1**: Butyl Rubber based Joint Sealants: ASTM C 1311
   1. Tremco General Purpose Butyl Sealant or Equal

2.5 LATEX JOINT SEALANTS

A. **Type L-1**: Latex Joint Sealant: Acrylic latex or Siliconized Acrylic Latex: ASTM C834, Type OP, Grade NF or better
   1. Tremco Tremflex 834 or Equal.

B. **Type L-2**: Paintable Mildew-Resistant Latex Joint Sealant: Acrylic Latex or Siliconized Acrylic Latex: ASTM C834, Type OP, Grade NF or better.
   1. Tremco Tremflex 834 or Equal.

2.6 ACCESSORIES

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and

density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Oversized to 30 to 50 percent larger than joint width.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

E. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated. Non-staining type, recommended by sealant manufacturer to suit application.

F. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

G. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate surfaces and joint openings are ready to receive work.

B. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

3.4 SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and non-traffic horizontal surfaces.
1. Joint locations such as, but not limited to:
    a. Construction joints in cast-in-place concrete.
    b. Control joints in unit masonry.
        1) Provide joint sealants slightly darker than the adjacent masonry units. Provide multiple colors as may be required for match.

c. Perimeter joints between masonry, concrete, or stone and frames of doors, windows, storefronts, louvers, and similar openings.
d. Lintels and shelf angles to masonry construction.
e. Butt joints between metal panels.
f. Control and expansion joints in ceiling/soffit and similar overhead surfaces.
g. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by various methods of construction to make building watertight.
h. Other joints as indicated on Drawings.

2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type S-1, Type S-2, Type S-3**
3. Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint locations such as, but not limited to:
a. Isolation joints in cast-in-place concrete slabs.
b. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.
c. Areas around all piping systems that penetrate the slab or foundation walls below grade (utility trenches, electrical conduits, plumbing penetrations, etc.).
d. Control and expansion joints in tile flooring.
e. Other joints as indicated on Drawings.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type S-4**
3. Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces, subject to movement, unless otherwise noted.
1. Joint locations such as, but not limited to:
a. Control joints on exposed interior surfaces of exterior walls.
b. Interior joints where interior partitions meet exterior walls of dissimilar materials and components.
c. Other joints as indicated on Drawings.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type U-1**
3. Color: As selected by Architect from manufacturer's full range of colors. Paintable Sealant, prep for painted finish.

D. Joint-Sealant Application: Interior joints in vertical surfaces subject to abuse and movement.
1. Joint locations such as, but not limited to:
a. Vertical joints, including control joints and joints between masonry and structural support members, on exposed surfaces of interior unit masonry walls and partitions.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type U-2**
3. Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces not subject to movement.
1. Joint locations such as, but not limited to:
a. Interior perimeter joints of exterior openings.
b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
c. Interior joints between dissimilar materials where a gap is created where materials meet, unless otherwise noted.
2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type L-1, Type L-2**
3. Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in non-painted vertical surfaces and horizontal nontraffic surfaces.
   1. Joint locations such as, but not limited to:
      a. Interior joints between plumbing fixtures and adjoining floors and counters.
      b. Joints between countertops and backsplashes.
      c. For interior joints in non-painted vertical and horizontal surfaces where incidental food contact may occur.
      d. Tile control and expansion joints where indicated.
      e. Other joints as indicated on Drawings.
   2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type S-5**
      a. For potable water storage sealant shall be certified by National Sanitation Foundation as conforming to the requirements of NSF Standard 61 – Drinking Water System Components – Health Effect.
      b. For surfaces where incidental food contact may occur sealant must comply with United States Department of Agriculture (USDA) guidelines for incidental food contact with cured sealant.
   3. Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Mildew-resistant interior joints in painted vertical surfaces and horizontal non-traffic surfaces.
   1. Joint locations such as, but not limited to:
      a. Interior joints between plumbing fixtures and adjoining painted walls.
      b. Joints where countertops or backsplashes intersect painted walls.
      c. For interior joints in painted vertical and horizontal surfaces where incidental food contact may occur.
   2. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type L-2**
   3. Color: As selected by Architect from manufacturer's full range of colors.

H. Joint-Sealant Application: Interior or exterior joints in vertical surfaces between laps in fabrications of sheet metal.
   1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type U-1**
   2. Color: As selected by Architect from manufacturer's full range of colors.

I. Joint-Sealant Application: Exterior joints under metal thresholds and saddles, sill plates, or as bedding sealant for sheet metal flashing and frames of metal or wood.
   1. Provide one of the following acceptable sealants as approved by manufacturer for substrates and uses indicated: **Type S-1, Type U-1, Type B-1**
   2. Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 08 11 15 - PRE-ASSEMBLED METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pre-assembled steel entry doors in wood / composite frames.

1.2 SUBMITTALS

A. Product Data: Submit frame and door configurations, core materials, finishes, fire ratings, and Energy Star Compliance.

1.3 QUALITY ASSURANCE

A. Perform glazing Work in accordance with the following:
   1. Insulated Glass: Fabricate insulated glass units in accordance with GANA (formerly FGMA) Glazing Manual.
   2. Safety Glass: Conform to CPSC 16 CFR 1201 and applicable codes.

B. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

D. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
   1. Installer shall be certified by Manufacturer.

1.4 WARRANTY

A. Furnish five year manufacturer’s warranty on workmanship and materials.

B. Furnish five year manufacturer’s warranty for insulated glass units from seal failure, interpane dusting or misting, including replacement.

PART 2 PRODUCTS

2.1 PRE-ASSEMBLED STEEL DOORS AND FRAMES

A. Manufacturers:
   1. Masonite: High Definition Steel Entry Doors.
   2. Therma-Tru: Profiles Steel Entry Doors, Equal to Above Style.
   3. Jeldwen: Premium Steel Exterior Door, Equal to Above Style.
   4. Lansing Housing Products

2.2 ENTRY DOORS

A. Construction: Tension-leveled cold rolled steel, zinc-coated, conversion coated to permit paint bond skins:
   1. Thickness: 1-3/4 inch thick; 24 gauge steel sheet face, 0.021 inch minimum.
   2. Door surface: smooth, flush style with glazed openings, design as indicated on Drawings
   3. Door Core Construction: Thermally Broken, wood stiles and rails, with foamed in place insulation.
   4. Door Edges: Machinable kiln-dried pine or engineered composite lumber mechanically locked to door faces, four sided full thermal break provided, lock area reinforced with solid blocking in full area of passage and deadbolt locksets.
   5. Door Bottom Edge: Moisture- and decay-resistant composite.

6. Door Bottom Edge Weatherstripping: Bottom Sweep compatible with accessible threshold; provide corner seal pads as required to seal bottom of door at frame.
7. Core: Foamed-in-place polyurethane, density 1.9 pcf minimum.
8. Finish: White primed. [ready for field paint]
9. Glazing Style: Clear, Full lite insulated glazing.
10. Door Configuration: Frame hinge, inswing patio door – sized to fit existing rough opening / door being removed, left and right hand configurations to match existing.
11. Energy Efficiency: Maximum U-Value of 0.30.

2.3 DOOR FRAMES

A. Composite Frames: Rot-resistant door frame, mullions, and brickmold, as supplied by Door manufacturer. Formed with integral stop for weatherstripping; accessible style threshold.
   1. Jamb Width: +/- 6-9/16 inch; Match existing wall thickness, field verified by Contractor.
   2. Mullion: Storm door ready Mullion [& Adaptor as required]; nominal 2 inch width
   3. Trim: Composite 2” brickmold
   4. Sill: High Dam type unless located in accessible unit
   5. Hinges: Steel, full mortise butt hinges; 4 x 4 inches, finish to match door hardware specified in Section 08 71 00.
   6. Finish: Painted

2.4 COMPONENTS

A. Steel Sheet: Galvanized to ASTM A653/A653M G60 coating class.

B. Insulation: Polyurethane.

C. Insulating Glass: Sealed double pane units with Low E coating with internal grid. Max U-Value of 0.30.
   1. Outer Pane: Clear fully tempered safety glass, Low-E Coating.
   2. Inner Pane: Clear fully tempered safety glass.
   3. Pane Thickness: Minimum 1/8 inch thick.
   4. Minimum Total Unit Thickness: 5/8 inch minimum.
   5. Internal Decorative Pattern: as indicated on Drawings.

2.5 HARDWARE

A. Weatherstripping: Jacketed, thermoset open-cell foam, press-fit in kerfs at jamb stops in frames. Medium Reach Compression type; Bottom sweep compatible with accessible threshold.
   1. Note: insulation shall be installed to fully prevent passage of light and air thru any gaps in the frame and door leaf.

B. Hardware Finish: US 26D [unless directed Otherwise by Owner]

C. Remainder of Hardware: Specified in Section 08 71 00.

2.6 ACCESSORIES

A. Door Casings:
   1. Exterior: 2 inch brickmold or 1x trim
   2. Interior: wood casing.

B. Bituminous Coating: Non-asbestos fibered asphalt emulsion.

C. Primer: Manufacturer's standard rust inhibitive type.

2.7 FABRICATION

A. Fabricate doors and frames as pre-hung single piece jamb units with continuous threshold for each opening.

B. Fabricate pre-hung units with hardware reinforcement welded in place.

C. Configure exterior frames to accept weatherstripping.

D. Factory glaze doors.

E. Attach fire rating label to each fire rated door and frame.

2.8 FACTORY FINISHING

A. Doors and Frames:
   1. Primer: Baked on dry powder.
   2. Finish Coating: Field Applied.

B. Hardware Finish:
   1. Steel Components: Satin chrome finish or with finishes to match door hardware as applicable.
   2. Aluminum Components: Mill finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify framed openings are correct size and thickness and project conditions are acceptable.

3.2 INSTALLATION

A. Install units in accordance with manufacturers installation instructions.

B. Install fire rated assemblies in accordance with NFPA 80.

C. Install doors and frames plumb, level and square.

D. Coordinate installation of hardware specified in Section 08 71 00.

E. Field Finishing: As specified in Section 09 90 00.

F. Adjust door and frame units to ensure smooth and balanced movement.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.4 SCHEDULES

A. Exterior Entry Doors: Steel door with wood / composite frame; sized per drawings, style as indicated on drawings; with continuous threshold. Hardware per section 08 71 00.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hardware exterior patio doors being replaced as part of this project.
   1. Provide cylinders and keys for all doors.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedule, and catalog cuts.
   2. Submit manufacturer's parts list, and templates.

B. Manufacturer's installation instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of installed cylinders and their master key code.

B. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

C. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following requirements:
   1. ANSI A156 series.
   2. NFPA 80 - Fire Doors and Windows.
   3. NFPA 101 - Life Safety Code.

B. Furnish hardware marked and listed in BHMA Directory of Certified Products.

C. Coordinate work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
   1. Provide templates or actual hardware as required to ensure proper preparation of doors and frames.

D. Coordinate Owner's keying requirements during course of work.

1.5 WARRANTY

A. Furnish five year manufacturer warranty for door hardware.

1.6 MAINTENANCE SERVICE

A. Provide special wrenches and tools applicable to each different or special hardware component.

PART 2 PRODUCTS

2.1 DOOR HARDWARE

A. Lockset, Latch Set, and Cylinder Manufacturers:
   1. KwikSet Delta Lever Latchset [match building standard]

B. Deadlock Manufactures:
   1. KwikSet SmartKey – Key Control Deadbolt [match building standard].

C. Cylinders: Match CMHA standards, field verify all requirements.

2.2 COMPONENTS

A. General Hardware Requirements: Where not specifically indicated, comply with applicable ANSI A156 standard for type of hardware required. Furnish each type of hardware with accessories as required for applications indicated and for complete, finished, operational doors.
   1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently in advance to avoid delay in Work.
   2. Reinforcing Units: Furnished by door and frame manufacturers; coordinated by hardware supplier or hardware manufacturer.
   3. Fasteners: Furnish as recommended by hardware manufacturer and as required to secure hardware.
      a. Finish: Match hardware item being fastened.

B. Hinges: ANSI A156.1, full mortise type, template type, ANSI A156.7, complying with following general requirements unless otherwise scheduled.
   1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
   2. Number: Furnish minimum three hinges to 90 inches high, four hinges to 120 inches high for each door leaf.
   3. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior doors, non rising pins at interior doors.
   4. Tips: Flat button tips with matching plug.

C. Locksets: Furnish locksets compatible with specified cylinders. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt verify type of cutouts provided in metal frames.
   1. Bored (Cylindrical) Locksets: ANSI A156.2, Grade 3 unless otherwise indicated.

D. Latch Sets: Match locksets. Typical 2-3/4” backset. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt.
   1. Bored (Cylindrical) Latchsets: ANSI A156.2, Grade 3 unless otherwise indicated.

E. Push/Pulls, Gaskets, Thresholds, and Trim: Furnish as indicated in Schedule, with accessories as required for complete operational door installations.
   1. Weatherstripping: Furnish continuous weatherstripping at top and sides of exterior doors.
   2. Thresholds: Standard high dam type at non accessible dwelling units.

F. Cylinders: Match Owner Standard.

G. Keying: Keyed as directed by Owner to integrate with existing Keying Schedule.
   1. Keys: Nickel silver. Stamp keys with “DO NOT DUPLICATE”.
   2. Supply keys in the following minimum quantities
      a. 3 keys per residential unit.

2.3 ACCESSORIES

A. Lock Trim: Furnish levers with 2 3/8” rose.

B. Through Bolts: Through bolts and grommet nuts are not permitted on door faces in occupied areas unless no alternative is possible.
   1. Do not permit through bolts on solid wood core doors.

2.4 FINISHING

A. Finishes: ANSI A156.18; with following finishes except where otherwise indicated in Schedule at end of section.
   1. Hinges: Satin nickel.
   2. Exterior Door Hardware: Satin nickel

3. Thresholds: Finish appearance to match door hardware on exterior face of door.
4. Other Items: Provide manufacturer's standard finishes matching similar hardware types on same door, and maintaining acceptable finish considering anticipated use and BHMA category of finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify doors and frames are ready to receive work and dimensions are as indicated on shop drawings and as instructed by manufacturer.

3.2 INSTALLATION

A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.

B. Mounting Heights from Finished Floor to Center Line of Hardware Item: Comply with manufacturer recommendations and applicable codes.
1. Locksets: 38 inches
2. Dead Bolt: 48 inches
3. Top Hinge: Jamb manufacturer's standard, but not greater than 10 inches from head of frame to centerline of hinge.
4. Bottom Hinge: Jamb manufacturer's standard, but not greater than 12-1/2" from floor to centerline of hinge.
5. Intermediate Hinges: Equally spaced between top and bottom hinges and from each other.

3.3 ADJUSTING

A. Adjust hardware for smooth operation.

3.4 SCHEDULE

A. The following hardware sets are intended to establish type and standard of quality when used together with these section requirements. Examine Drawings and Specifications and furnish proper hardware for door openings.

1. Each new door requires two (2) of the Rockwood 528 stop. Also provide wall mounted plastic door stop plate at any door adjacent to a gypsum wall.

Hardware Set H-1: Patio Entry Doors

Hinges:	1-1/2 pair, 4x4 butt hinges
Stops:	Rockwood 528, plastic wall plate
Lock Set:	ANSI function F75 [passage latchset]
Dead Bolt	ANSI function E0152 [deadbolt with interior thumbturn]
Weatherstripping	Compression type
Threshold	Standard, high dam threshold

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of paints and other coatings.

B. Paint/Stain all exposed surfaces, new and existing, unless otherwise indicated.
   1. Exterior Work:
      a. Fiber Cement Siding and Trim
      b. Wood and Composite Trim
      c. Exterior Doors and Frames.
      d. Miscellaneous exterior trim.
      e. Steel Lintels

C. Do not paint prefinished items, finished metal surfaces, operating parts, labels, and materials obviously intended to be left exposed such as brick and tile.

D. Unless otherwise indicated do not paint concealed surfaces.

E. Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats. Primer and finish coat shall be factory applied, finish coat shall be field applied.

F. **Extra Materials**: Deliver to Owner **any extra materials**, properly labeled, factory sealed, of each color and type of finish coat paint used on project for each building in contract.

G. Minimum surface temperature of 50 degrees required for all coating systems.

H. Store all materials in tightly closed containers when not in use, away from heat, electrical equipment, sparks and open flames. Use approved bonding and grounding procedures. Keep out of the reach of children and residents.

I. Transfer materials to approved containers with complete and appropriate labeling.

1.2 APPLICATORS QUALIFICATIONS

A. Engage an experienced applicator with a minimum of <u>five</u> years experience and who has completed painting systems application similar in materials and extend to those indicated for the Project and that have resulted in a construction record of successful in-service performance.

1.3 SUBMITTALS

A. Product Data and Color Samples: Provide product data on each coating system component indicating VOC and environmental requirements. Coordinate coating systems for each material/substrate.

1.4 REFERENCES AND REGULATIONS:

A. Standards: Comply with applicable provisions and recommendations of the following, except when otherwise shown or specified:
   1. OSHA Safety Standards for the Construction Industry, Title 29 - Labor, Subtitle B – Regulations Relating to Labor, Occupational Safety and Health Administration (OSHA) 1926, 07/01/93 editions.
   2. OSHA Worker Safety and Health Act Regulation 29 CFR No. Parts 1900 through 1910.1400, 07/01/93 and later editions.
   3. SSPC Volume 1, Good Painting Practice, 1989 edition.
   4. SSPC Volume 2, Systems and Specifications, 1991 edition, Surface Preparation Guide and Paint Application Specifications of the Steel Structures Painting Council.

5. NACE Standards, Volume I and II, 1992 editions of the National Association of Corrosion Engineers.
6. SSPC and NACE Painter Safety Guidelines, latest editions.

B. Requirements of Regulatory Agencies, conform with the following:
1. Clean Air Act (CAA) – hazardous Air Emissions by U.S. EPA or State Agency under Regulation 40 CFR 61 or state equivalent.
2. Clean Water Act (CWA) – hazardous Water Releases by U.S. EPA or State Agency under Regulation 40 CFR 116 through 117 or state equivalent.
3. Toxic Substances Control Act (TSCA) – Toxic substance by U.S. EPA under Regulation 40 CFR 761.
4. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or "SuperFund") – Uncontrolled Hazardous Waste Sites and Hazardous Substance Release by U.S. EPA under Regulation 40 CFR 302.
5. Resource Conservation and Recovery Act (RCRA) – Generation, Transportation, Treatment, Storage and Disposal of hazardous waste by U.S. EPA or State Agency under Regulation 40 CFR 260 through 267 or state equivalent.
6. Hazardous and Solid Waste Amendments (HSWA) – Further regulation of hazardous waste by U.S. EPA or State Agency under Regulation 40 CFR through 267 or state equivalent.
7. Hazardous Material Transportation Act (HMTA) – Transportation of Hazardous Material by DOT or State Agency under Regulation 49 CFR 171 through 179 or state equivalent.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit maintenance and cleaning instructions.

1.6 QUALITY ASSURANCE

A. Surface Burning Characteristics:
1. Fire Retardant Finishes: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Store and apply materials in environmental conditions required by manufacturer's instructions.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information:
1. Product name and type (description)
2. Application & use instructions
3. Surface preparation
4. VOC content
5. Environmental handling and an SDS
6. Batch date
7. Color number

B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

C. Handling: Maintain a clean, dry storage area to prevent contamination or damage to the coatings.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

1.10 MOCKUP

A. Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections and demonstrate aesthetic effects and set quality standards for materials and execution.

PART 2 PRODUCTS

2.1 PAINT AND COATINGS

A. Manufacturer
   1. Sherwin-Williams (SW) – Basis of Design
   2. PPG Porter
   3. Benjamin Moore

B. Paints and Coatings - General:
   1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such a procedure is specifically described in manufacturer's product instructions. VOCs need to be confirmed by using the products EDS sheets.

C. Primers:
   1. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

D. Coating Application Accessories:
   1. Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required per manufacturer’s specifications.

E. Colors: As selected from a full range of manufacturer’s offerings, including premium colors.

F. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.
   1. Lead: Measurable lead content in either the pigment or binder will not be permitted.
   2. The finish coats shall match colors selected.

G. Finish Quality:
   1. Finishes shall exhibit a high quality, commercial grade appearance of uniform thickness.
   2. Finishes shall be free of runs, sags, drips, waves, orange peel, festoons, dry spray, cloudiness, spotting, ropiness, brush marks, roller marks, fish eyes or other surface imperfections, voids, discontinuities, pinholes, holidays and overspray.
   3. Final coat shall be uniform in texture, color and gloss, and shall provide an acceptable match with the approved drawdown sample sheet.

H. Provide for a <u>minimum</u> of the following:
   1. Exterior Finishes: 4 colors [allow for different colors at different buildings]

2.2 EXTERIOR PAINT APPLICATION SCHEDULE

General: All coatings shall be applied according to manufacturer's application instructions, including application rates for wet film and dry film thickness.

A. Exterior Fiber Cement Siding, Trim, Composite Trim, etc: [Satin Finish]
   1. 1st Coat: S-W Exterior Latex Wood Primer, B42W8141; or S-W Exterior Oil-Based Wood Primer [refer to S-W], not required for pre-primed materials.

2. 2nd Coat: S-W Duration Exterior Acrylic Latex Satin, K33-Series
3. 3rd Coat: S-W Duration Exterior Acrylic Latex Satin, K33-Series

B. Metals - Ferrous: [Semi-Gloss Finish]
1. 1st Coat: S-W Pro-Industrial Pro-Cryl Primer [as required to suit conditions]
2. 2nd Coat: S-W Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-1150/2150 Series
3. 3rd Coat: S-W Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-1150/2150 Series

C. Metals – Aluminum / Galvanized: [Semi-Gloss Finish]
1. 1st Coat: S-W Pro Industrial DTM Acrylic Primer / Finish, B66 Series
2. 2nd Coat: S-W Pro Industrial DTM Acrylic Enamel Semi-Gloss, B66 Series
3. 3rd Coat: S-W Pro Industrial DTM Acrylic Enamel Semi-Gloss, B66 Series

D. Exterior Doors and Frames [Semi-Gloss Finish]
1. 1st Coat: S-W Pro-Industrial Pro-Cryl Primer [as required to suit conditions]
2. 2nd Coat: S-W Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-1150/2150 Series
3. 3rd Coat: S-W Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-1150/2150 Series

E. Miscellaneous metals and steel lintels:
1. 1st Coat: S-W DTM Acrylic Primer/Finish.
2. 2nd Coat: S-W SW DTM Acrylic Semi-Gloss Enamel Semi-Gloss, Acrylic Coating.
3. 3rd Coat: S-W SW DTM Acrylic Semi-Gloss Enamel Semi-Gloss, Acrylic Coating.

2.3 PRE-CLEANING AND SURFACE PREPARATION PRODUCTS

A. Pre-cleaning Agents
1. SW No Rinse Prepaint Cleaner
2. Krud Kutter
3. Potable water

B. Pre-cleaning (Power Wash) Equipment
1. Capacity to continuously deliver 3-5 gpm at 2,500 psig of 180-200 degree F hot water.
2. Cleaning system shall affect the 32-ounce per gallon dilution.
3. Manufacturer: Alkota, Model 565T with model 520 water heater or approved equal.
4. Power wash with 15 degree tip capable of delivering hot water at 2500 psig.

C. Power Tool Surface Preparation Media:
1. Scotch Brite No. 07451 by 3 M Corporation, Surface Conditioning disc.
   a. Properties
   b. Texture: A Medium
   c. Maximum Speed: 18,000 RPM
2. Clean ‘N" Strip Disco No CSD2 by 3 M Corporation
   a. Texture: Course
   b. Maximum Speed: 8,000 RPM
   c. Or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of coatings until substrates have been properly examined and prepared. Notify Architect of unsatisfactory conditions before proceeding.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Proceed with work only after conditions have been corrected, and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

D. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

3.2 SURFACE PREPARATION

A. Comply with paint manufacturer's written instructions for surface preparation, environmental and substrate conditions, product mixing, and application.

B. Perform all surface preparation in accordance with SSPC specifications, guidelines and good painting practices.

C. Proper product selection, surface preparation, and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to the substrate and prolongs the service life of the coating system.

D. Selection of the proper method of surface preparation depends on the substrate, the environment, and the expected service life of the coating system. Economics, surface contamination, and the effect on the substrate will also influence the selection of surface preparation methods.

E. The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

F. Prior to attempting to remove mildew, it is always recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions may be advised.

G. Mildew may be removed before painting by washing with a solution of 1 part liquid bleach and 3 parts water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with water and allow the surface to dry before painting. Wear protective eyewear, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

H. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50°F, unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50°F or higher to use low temperature products.

I. Methods:
   1. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
   2. Block (Cinder and Concrete): Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75°F unless the manufacturer’s products are designed for application prior to the 30-day period. The pH of the surface should be between 6 and 9 unless the products are designed to be used in high pH environments. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound.
   3. Concrete, SSPC-SP13 or NACE 6: This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.
   4. Cement Composition Siding/Panels: Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked

paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.

5. Drywall—Exterior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting. Exterior surfaces must be spackled with exterior grade compounds.
6. Exterior Composition Board (Hardboard): Some composition boards may exude a waxy material that must be removed with a solvent prior to coating. Whether factory primed or unprimed, exterior composition board siding (hardboard) must be cleaned thoroughly and primed with an alkyd primer.
7. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.
8. Steel: Structural, Plate, etc.: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
9. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
10. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before Hand Tool Cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
11. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before Power Tool Cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
12. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
13. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
14. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.
15. Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals, SSPC-SP16: This standard covers the requirements for brush-

off blast cleaning of uncoated or coated metal surfaces other than carbon steel by the use of abrasives. These requirements include visual verification of the end condition of the surface and materials and procedures necessary to achieve and verify the end condition. A brush-off blast cleaned non-ferrous metal surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, metal oxides (corrosion products), and other foreign matter. Intact, tightly adherent coating is permitted to remain. A coating is considered tightly adherent if it cannot be removed by lifting with a dull putty knife.

16. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
17. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
18. Water Blasting, NACE Standard RP-01-72: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.
19. Stucco: Must be clean and free of any loose stucco. If recommended procedures for applying stucco are followed, and normal drying conditions prevail, the surface may be painted in 30 days. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments such as Loxon.
20. Wood—Exterior: Must be clean and dry. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.
21. Vinyl Siding, Architectural Plastics & Fiberglass or other PVC, plastic building products. Clean the surface thoroughly by scrubbing with warm, soapy water. Rinse thoroughly, prime with appropriate white primer. Do not paint vinyl with any color darker than the original color. Do not paint vinyl with a color having a Light Reflective Value (LRV) of less than 56 unless VinylSafe® Colors are used. If VinylSafe® Colors are not used and darker colors lower than an LRV of 56 are, the vinyl may warp. Follow all painting guidelines of the vinyl manufacturer when painting. Only paint properly installed vinyl siding. Deviating from the manufacturer's painting guidelines may cause the warranty to be voided.

3.3 APPLICATION

A. Examination and Verification of Condition: Contractor shall verify the areas and conditions under which the work is to be performed and notify the Owner in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until satisfactory conditions have been corrected. Do not coat over chalk, dirt, scale, moisture, oil, surface contaminants, coatings that have exceeded the manufacturer’s re-coat guidelines, or conditions otherwise detrimental to the formation of a durable high quality coating system.

B. Comply with manufacturer’s instructions and SSPC Good Paint Practices Volumes 1 and 2.

C. Comply with OSHA regulations, State of Ohio and Federal laws, ordinances, and guidelines.

D. Follow manufacturer’s requirements for temperature and humidity at time of application.

E. Refer to SDS sheets before using any product.

F. All surfaces must be thoroughly dry before coating applications. Do not apply to wet or damp surfaces.
   1. Wait at least 30 days before applying to new concrete or masonry or follow manufacturer's procedures to apply appropriate coatings prior to 30 days.
   2. Test new concrete for moisture content.
   3. Wait until wood is fully dry after rain or morning fog or dew.

G. Apply coatings using brush or roller only.

H. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendation.

I. Apply coatings using methods recommended by manufacturer.

J. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

K. Apply coatings at spreading rate required to achieve the manufacturer's recommended dry film thickness.

L. Regardless of number of coats specified, apply as many coats as necessary for complete hide.

M. Exterior Woodwork: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 2 weeks.

N. Inspection: The coated surface must be inspected and approved by the Architect or Engineer just prior to the application of each coat.

3.4 CLEAN UP

A. Clean site and remove debris and empty cans daily. Remove all paint from adjacent surfaces. Clean spills and splatters immediately.

B. Clean hands and tools immediately after use with soap and water for water based products and with mineral spirits for oil based products.

C. Follow manufacturer's safety recommendations when using mineral spirits.

3.5 ENVIRONMENTAL REQUIREMENTS

A. Store and apply materials in environmental conditions required by manufacturer's instructions.

END OF SECTION

Envisage
ARCHITECTURE

7. REFERENCE SUSTAINABLE DOCUMENTS

3244 Fairfield Ave ■ Cincinnati, OH 45207 ■ www.envisage-arch.com ■ 513.409.0609

Sol design + consulting

agenda

Enterprise Green Communities (EGC) Design Charrette
Linn St Exchange
Tulsa, OK

15 July 2025
9:00 am

Attendees: See attached attendee list.

The purpose of the meeting is to introduce the design and construction team to the EGC certification process; to integrate green strategies across all aspects of design, drawings and trades expertise; and to set expectations to ensure a successful EGC certification.

1 Introductions

- Project team, qualifications, roles, and responsibilities

2 Overview of EGC Process

- EGC Rating System
- Players – Provider, Rater, Design & Construction Team

3 EGC Certification Process

- EGC Criteria
  - Certification Threshold & Additional requirements
  - Prerequisite & Credits
  - Energy Model Review
- Energy Star Requirements and Checklist
  - Green Rater Design & Inspection Checklists
  - HVAC Design & Commissioning Checklists
  - GC Water Management Builder Checklist
- Field Visual Inspections – Thermal Bypass (Pre-Drywall)
- Field Testing – Air Infiltration, Distribution Loss (Total Duct Leakage & Duct Leakage to Outside), Duct Static Pressure, Room Pressure Test
- Document Inspections – Plans and Specs; calculations (Mechanical, water use, landscaping, etc.); Product data sheets

FOR REFERENCE

4 Project Schedule

- EGC Pre-build
- EGC Checklist and Energy Model Review
- Construction Start – Trades Training
- Mid Construction Inspections
- Post Construction Inspections & Testing
- Close-out Process
- Project Certification

5 External Deliverables during Design

- Revit/CAD files
- Energy Star HVAC Design Checklist
- 80% Progress for EGC plan review

6 Closing Remarks

SIGN-IN SHEET

Name	Company	Trade	Email	Phone #

CRITERIA CHECKLIST

This checklist provides an overview of the technical requirements within the Enterprise Green Communities Criteria.

To achieve Enterprise Green Communities Certification, all projects must achieve compliance with the Criteria mandatory measures applicable to that construction type. **New Construction projects must also achieve at least 40 optional points, and Substantial and Moderate Rehab projects must also achieve at least 35 optional points.**

These projects that also comply with Criterion 5.2b or Criterion 5.4 will be recognized with Enterprise Green Communities Certification Plus.

Project:	Linn St Exchange
Address:	1400, 1500 Linn St
Location Type:	Urban
Building Type:	Midrise

FOR REFERENCE

Yes	Maybe		1. INTEGRATIVE DESIGN
Yes		M	**1.1 Integrative Design: Project Priorities Survey** Complete the Project Priorities Survey, which can be found in the Appendix.
Yes		M	**1.2 Integrative Design: Charrettes and Coordination Meetings** Develop an integrative design process that moves the outputs of the Project Priorities Survey into action through a series of collaborative meetings. Prioritize multi-benefit strategies. Assign responsibility within your design and development teams for accountability.
Yes		M	**1.3 Integrative Design: Documentation** Include Enterprise Green Communities Criteria information in your contract documents and construction specifications (Division 1 Section 01 81 13 Sustainable Design Requirements) as necessary for the construction team to understand the requirements and how they will be verified. Ensure and indicate, that the drawings and specifications have been generated to be compliant and meet the certification goals.
Yes		M	**1.4 Integrative Design: Construction Management** Create, implement, and document your contractor/subcontractor education plan to ensure that all persons working on-site fully understand their role in achieving the project objectives. Include a summary of the Project Priorities Survey (Criterion 1.1), the sustainability goals, and anticipated roles of each party in regards to the performance expected of the project. Attach and reference this training plan to Division 1 Section 01 81 13 Sustainable Design Requirements. Include timeline estimates for performance testing and verification schedules in the overall construction schedule. As relevant, review requirements for Criteria 8.1, 8.2, and 8.3, and begin populating these documents with relevant information from design and construction.
		12 or 15	**1.5 Design for Health and Well-Being: Health Action Plan** Follow Steps 1-6 of the Health Action Plan framework per the full criterion. *[12 points with extra 3 points for Step 7]* This includes: 1) Commit to embedding health into the project lifecycle; 2) Partner with a project health professional; 3) Collect and analyze community health data; 4) Engage with community stakeholders to prioritize health data and strategies; 5) Identify strategies to address those health issues; 6) Create an implementation plan; and 7) Create a monitoring plan.

		10	**1.6 Resilient Communities: Multi-Hazard Risk/Vulnerability Assessment** Conduct a four-part assessment (social, physical, functional, strategy) to identify critical risk factors of your property and implement at least two sets of strategies to enable the project to adapt to, and mitigate, climate related or seismic risks. See full criterion for more guidance.
		8	**1.7 Resilient Communities: Strengthening Cultural Resilience** Integrate community and resident participation in the development processes so that the built environment honors cultural identities, resident voices, and community histories. Option 1: Complete a Cultural Resilience Assessment OR Option 2: Convene a Cultural Advisory Group
0	0		1. INTEGRATIVE DESIGN SUBTOTAL
Yes	Maybe		**2. LOCATION + NEIGHBORHOOD FABRIC**
Yes		M	**2.1 Sensitive Site Protection** All projects must: 1. Protect floodplain functions (e.g., storage, habitat, water quality) by limiting new development within the 100-year floodplain of all types of watercourses. 2. Conserve and protect aquatic ecosystems, including wetlands and deepwater habitats, that provide critical ecosystem functions for fish, other wildlife, and people. 3. Protect ecosystem function by avoiding the development of areas that contain habitat for plant and animal species identified as threatened or endangered. 4. Conserve the most productive agricultural soils by protecting prime farmland, unique farmland, and farmland of statewide or local importance. If your site contains any of these ecologically sensitive features, follow the specific Requirements under that subheading.
N/A		M	**2.2 Connections to Existing Development and Infrastructure** *(Mandatory for New Construction projects that do not qualify as Rural/Tribal/Small Town)* Locate the project on a site with access to existing roads, water, sewers, and other infrastructure and within or contiguous to (having at least 25% of the perimeter bordering) existing development. Connect the project to the existing pedestrian network. For sites over 5 acres, provide connections to the adjacent street network at least every 800 feet. Tie all planned bike paths to existing bike paths.
N/A		M	**2.3 Compact Development** *(Mandatory for New Construction)* At a minimum, build to the residential density (dwelling units/acre) of the census block group where the project is located. In Rural/Tribal/Small Town locations that do not have zoning requirements: Build to a minimum net density of 5 units per acre for single-family houses; 10 units per acre for multifamily buildings, single and two-story; and 15 units per acre for multifamily buildings greater than two-stories.

7		5 or 7	**2.4 Increased Compact Development** Exceed the residential density (dwelling units/acre) of the census block group in which your project is located. Exceed by 2x for *[5 points]* ; exceed by 3x for *[7 points]* . In Rural/Tribal/Small Towns that do not have zoning requirements, build to a minimum net density of 7.5 units per acre for single-family houses; 12 units per acre for multifamily buildings, single and two-story; and 20 units per acre for multifamily buildings greater than two stories. *[5 points]*
N/A		M	**2.5 Proximity to Services and Community Resources** *(Mandatory for New Construction)* Locate the project within a 0.5-mile walk distance of at least four, or a 1-mile walk distance of at least seven, of the listed services. For projects that qualify as Rural/Tribal/Small Town, locate the project within 5 miles of at least four of the listed services.
N/A		M	**2.6 Preservation of and Access to Open Space for Rural/Tribal/Small Town** *(Mandatory for New Construction Rural/Tribal/Small Town)* Option 1: Locate the project within a 0.25-mile walk distance of dedicated public open space that is a minimum of 0.75 acres; at least 80% of which unpaved. OR Option 2: Set aside a minimum of 10% (minimum of 0.25 acres) of the total project acreage as open and accessible to all residents; at least 80% of which unpaved.
4		6 max	**2.7 Preservation of and Access to Open Space** Option 1: Locate the project within a 0.25-mile walk distance of dedicated open space that is a minimum of 0.75 acres; at least 80% of which unpaved. *[4 points]* OR Option 2: Set aside a percentage of permanent open space for use by all residents; at least 80% of which unpaved. 25% *[2 points] ;* 35% *[4 points] ;* 45% + written statement of preservation/ conservation policy *[6 points].*
			2.8 Access to Transit *(Mandatory for New Construction projects that do not qualify as Rural/Tribal/Small Town; Optional for all other project types)*
N/A		M	**Mandatory: New Construction, not Rural/Tribal/Small Town** Locate projects within a 0.5-mile walk distance of transit services (bus, rail and/or ferry), constituting at least 45 or more transit rides per weekday, with some type of weekend service.
		2	**Optional: New Construction, not Rural/Tribal/Small Town** Locate the project along dedicated bike trails or lanes (Class I, II, or IV) that lead to high-quality transit services (100 trips per day) within 3 miles. *[2 points]*
6		2, 6, 8	**Optional: Rehabilitation, not Rural/Tribal/Small Town** Locate projects within a 0.5-mile walk distance of public transit services (bus, rail and/or ferry), constituting at least 45 or more transit rides per weekday, with some type of weekend service. [6 points] Locate the project along dedicated bike trails or lanes (Class I, II, or IV) that lead to high-quality transit services (100 trips per day) within 3 miles. *[2 points]*
		6	**Optional: New Construction and Rehabilitation, Rural/Tribal/Small Town** Locate the project within 0.5 mile walk distance of public transit services with at least 45 rides per weekday and some weekend service. OR, Install at least two charging stations for electric vehicles. OR, Locate the project with 5 miles of one of the following transit options: 1) vehicle share program; 2) dial-a-ride program; 3) employer vanpool; 4) park-and-ride; 5) public/private regional transportation.

		2-8	**2.9 Improving Connectivity to the Community** Improve access to community amenities through at least one of the options incentivizing biking mobility or improving access to transit.
		5 max	**2.10 Passive Solar Heating/Cooling** Design and build with passive solar design, orientation, and shading that meet the guidelines specified.
		6	**2.11 Adaptive Reuse of Buildings** Rehabilitate and adapt an existing structure that was not previously used as housing. Design the project to adapt, renovate, or reuse at least 50% of the existing structure and envelope.
		6	**2.12 Access to Fresh, Local Foods** Provide residents and staff with access to fresh, local foods through one of the following options: Option 1: Neighborhood Farms and Gardens Option 2: Community-Supported Agriculture Option 3: Proximity to Farmers Market
8		8	**2.13 Advanced Certification: Site Planning, Design and Management** Locate building(s) within a community that is certified in LEED for Neighborhood Development, LEED for Cities and Communities, Living Community Challenge, or SITES.
		6 max	**2.14 Local Economic Development and Community Wealth Creation** Demonstrate that local preference for construction employment and subcontractor hiring was part of your bidding process, and how it functioned during construction. *[2 points]* OR Demonstrate that you achieved at least 20% local employment. *[3 points]* OR Provide physical space for small business, nonprofits, and/or skills and workforce education. *[3 points]*
N/A		M	**2.15a Access to Broadband: Broadband Ready** *(Mandatory for New Construction and Substantial Rehab Projects in Rural/Tribal/Small Town Locations)* Incorporate broadband infrastructure so that when broadband service comes to a community, the property can be easily connected. Include a network of mini-ducts or conduit throughout the building, extending from the expected communications access point to each network termination point in the building.
		6	**2.15b Access to Broadband: Connectivity** Ensure all units and common spaces in the property have broadband internet access with at least a speed of 25/3 mbs.
25	**0**		**2. LOCATION + NEIGHBORHOOD FABRIC SUBTOTAL**

Yes	Maybe		3. SITE IMPROVEMENT
Yes		M	**3.1 Environmental Remediation** Determine whether there are any hazardous materials present on the site through one of the four methods listed. Mitigate any contaminants found.
Yes		M	**3.2 Minimization of Disturbance during Staging and Construction** For sites >1 acre, implement EPA's National Pollutant Discharge Elimination System Stormwater Discharges from Construction Activities guidance, or local requirements, whichever is more stringent. For sites with an area <= 1, follow guidance in full criterion.
Yes		M	**3.3 Ecosystem Services/Landscape** *(Mandatory, if providing landscaping)* If providing plantings, all must be native or climate-appropriate (adapted) to the region and appropriate to the site's soil and microclimate. Do not introduce any invasive plant species. Plant, seed, or xeriscape all disturbed areas.
Yes		M	**3.4 Surface Stormwater Management** *(Mandatory for New Construction; Mandatory for Substantial and Moderate Rehab projects if land disturbed is >= 5,000 sq.ft.)* Treat or retain on-site precipitation equivalent to the 60th percentile precipitation event. Where not feasible due to geotechnical issues, soil conditions, or the size of the site, treat or retain the maximum volume possible.
		10 max	**3.5 Surface Stormwater Management** Through on-site infiltration, evapotranspiration, and rainwater harvesting, retain precipitation volume from 70% precipitation event *[6 points],* 80% precipitation event *[8 points] ,* or 90% precipitation event *[10 points].*
		M	**3.6 Efficient Irrigation and Water Reuse** *(Mandatory, if permanent irrigation is utilized)* If irrigation is utilized, install an efficient irrigation system per the requirements listed.
		4 or 6	**3.7 Efficient Irrigation and Water Reuse** *(Optional, if irrigation is utilized)* Meet the requirements of Criterion 3.6 AND: Option 1: Install an efficient irrigation system equipped with a WaterSense labeled weather- based irrigation controller (WBIC) OR Option 2: At least 50% of the site's irrigation satisfied by water use from the sources listed.
0	0		3. SITE IMPROVEMENT SUBTOTAL

Yes	Maybe		4. WATER
Yes		M	**4.1 Water-Conserving Fixtures** Reduce total indoor water consumption by at least 20% compared to baseline indoor water consumption chart. Any new toilet, showerhead, and/or lavatory faucet must be WaterSense certified. For all single-family homes and all dwelling units in buildings three stories or fewer, the supply pressure may not exceed 60 psi.
3		6 max	**4.2 Advanced Water Conservation** Reduce total indoor water consumption by at least 30% compared to baseline indoor water consumption chart. Any new toilet, showerhead, and/or lavatory faucet must be WaterSense certified.
Yes			**4.3 Water Quality**
		M, 3	**Mandatory/Optional:** Mandatory for Substantial Rehabs of buildings built before 1986; Optional for all other building types: Replace lead service lines *[3 points]*
		M	**Mandatory:** For multifamily buildings with either a cooling tower, a centralized hot water system, or 10+ stories: Develop a Legionella water management program
		8	**Optional:** Test and remediate as indicated for lead, nitrates, arsenic, and coliform bacteria
		4	**4.4 Monitoring Water Consumption and Leaks** Conduct pressure-loss tests and visual inspections to determine if there are leaks; fix leaks. AND Install an advanced water monitoring and leak detection system capable of identifying and shutting water off during anomalous water events. OR Install a device to separately monitor water consumption of each cold branch off the apartment line riser for each dwelling unit or each cold water riser and the domestic hot water cold water feed for each building or each toilet that allows remote monitor readings; common laundry facilities; boiler makeup water; outdoor water consumption; and water consumption in any non-residential space.
		4	**4.5 Efficient Plumbing Layout and Design** Store no more than 0.5 gallon of water in any piping/manifold between the fixture and the water heating source or recirculation line. No more than 0.6 gallon of water shall be collected from the fixture before a 10-degree Fahrenheit rise in temperature is observed. Recirculation systems must be demand-initiated.
		6 max	**4.6 Non-Potable Water Reuse** Harvest, treat, and reuse rainwater and/or greywater to meet a portion of the project's non-potable water needs: 10% reuse *[3 points]* ; 20% reuse *[4 points]* ; 30% reuse *[5 points];* 40% reuse *[6 points].*

		8	**4.7 Access to Potable Water During Emergencies** Provide residents with ready access to potable water in the event of an emergency that disrupts normal access to potable water, including disruptions related to power outages that prevent pumping water to upper floors of multifamily buildings or pumping of water from on-site wells, per one of the three options listed.
3	0		4. WATER SUBTOTAL
Yes	Maybe		**5. OPERATING ENERGY**
		M	**5.1a Building Performance Standard** *(Mandatory for New Construction)* Certify all buildings with residential units in the project through either ENERGY STAR Multifamily New Construction, ENERGY STAR Manufactured Homes, and/or ENERGY STAR Certified Homes as relevant. AND Provide projected operating energy use intensity and projected operating building emissions intensity.
Yes		M	**5.1b Building Performance Standard** *(Mandatory for Rehab)* Provide projected operating energy use intensity and projected operating building emissions intensity. AND Conduct commissioning for compartmentalization, insulation installation, and HVAC systems as indicated. AND one of the following options: - ERI Option: <= HERS 80 for each dwelling unit. Exception for some Rehabs built before 1980. - ASHRAE Option: Energy performance of the completed building equivalent to, or better than, ASHRAE 90.1-2013 using an energy model created by a qualified energy services provider according to Appendix G 90.1-2016.
		12 max	**5.2a Moving to Zero Energy: Additional Reductions in Energy Use** *(Not available for projects using prescriptive path for Criterion 5.1a or for projects following Criterion 5.2b or 5.4.)* Projects in CZ 1-4A following this criterion must also comply with Criterion 7.8. Design and construct a building that is projected to be more efficient than what is required by Criteria 5.1a/b. Achieve HERS score of 5 lower than required by 5.1a/b if following ERI path for compliance OR 5% greater efficiency than required if following ASHRAE path for 5.1a/b compliance *[5 points].* Additional 1 point for each additional 2-point decrease in HERS score required by Criteria 5.1a/b if following ERI path for compliance OR for 1% greater efficiency if following ASHRAE path for Criteria 5.1a/b, up to a maximum of 12 optional points.
		12-15	**5.2b Moving to Zero Energy: Near Zero Certification** **[Mandatory for Enterprise Green Communities Certification Plus]** *(Not available for projects following Criterion 5.2a or 5.4.)* Projects in CZ 1-4A following this criterion must also comply with Criterion 7.8. Certify the project in a program that requires advanced levels of building envelope performance such as DOE ZERH *[12 points]* and/or PHI Classic or PHIUS+ *[15 points]* .

	3-6	**5.3a Moving to Zero Energy: Photovoltaic/Solar Hot Water Ready** *(Not available for projects following Criterion 5.3b or 5.4.)* Orient, design, engineer, wire, and/or plumb the development through the Photovoltaic Ready pathway or Solar Hot Water Ready Pathway to accommodate installation of photovoltaic (PV) or solar hot water system in the future.
	8 max	**5.3b Moving to Zero Energy: Renewable Energy** *(Not available for projects following Criterion 5.3a or 5.4)* Install renewable energy source to provide a specified percentage of the project's estimated source energy demand. See full criterion for allowable sources.
	4-8	**Option 1:** For percentage of total project energy consumption provided by renewable energy. OR
	1-5	**Option 2:** For percentage of common area meter energy consumption provided by renewable energy.
	24	**5.4 Achieving Zero Energy** **[Automatic Qualification for Enterprise Green Communities Certification Plus]** *(Not available for projects following Criterion 5.2a, 5.2b, 5.3a, or 5.3b.)* Projects in CZ 1-4A following this criterion must also comply with Criterion 7.8. Achieve Zero Energy performance through one of the following options: **Option 1:** Certify each building in the project to DOE Zero Energy Ready Home program or PHI Plus AND Either install renewables and/or procure renewable energy, which in sum will produce as much, or more, energy in a given year than the project is modeled to consume. OR **Option 2:** Certify each building in the project in a program that requires zero energy performance such as PHIUS+ Source Zero, PHI Plus, PHI Premium, ILFI's Zero Energy Petal, Zero Carbon Petal, or Living Building Certification.
	5 max	**5.5a Moving to Zero Carbon: All-Electric Ready** *(Not available for projects following Criterion 5.5b)* Ensure the project has adequate electric service and has been designed and wired to allow for a seamless switch to electricity as a fuel source in the future for the following uses: space heating *[1 point],* space cooling *[1 point]* , water heating (DHW) *[1 point]* , clothes dryers *[1 point]* , equipment for cooking *[1 point].*
	15	**5.5b Moving to Zero Carbon: All Electric** *(Not available for projects following Criterion 5.5a)* No combustion equipment used as part of the building project; the project is all-electric.
Yes	M	**5.6 Sizing of Heating and Cooling Equipment** *(Mandatory for Substantial and Moderate Rehabs that include replacement of heating and cooling equipment. Not relevant for projects following 5.1a, 5.2b, or 5.4.)* Size and select heating and cooling equipment in accordance with ACCA manuals J and S OR in accordance with the ASHRAE Handbook of Fundamentals

Yes		M	**5.7 ENERGY STAR Appliances** *(Mandatory for Substantial and Moderate Rehabs providing appliances. Not relevant for projects following 5.1a, 5.2b, or 5.4.)* Install ENERGY STAR clothes washers, dishwashers, and refrigerators. If appliances will not be installed or replaced at this time, specify that at the time of installation or replacement, ENERGY STAR models must be used via Criterion 8.1 and Criterion 8.4.
Yes		M	**5.8 Lighting** *(Mandatory for all lighting within New Construction and Substantial Rehab projects. Mandatory for new lighting in Moderate Rehab projects.)* Follow the guidance for high-efficacy permanently installed lighting and other characteristics for recessed light fixtures, lighting controls, lighting power density, and exterior lighting.
		8	**5.9 Resilient Energy Systems: Floodproofing** *(Not relevant for Rehab projects in Special Flood Hazard Areas)* Conduct floodproofing of lower floors, including perimeter floodproofing (barriers/shields). Design and install building systems as specified by the full criterion so that the operation of those systems will not be grossly affected in case of a flood.
		8	**5.10 Resilient Energy Systems: Critical Loads** Loads Provide emergency power to serve at least three critical energy loads as described by the full criterion. **Option 1**: Islandable PV system OR **Option 2**: Efficient generator
0	0		5. OPERATING ENERGY SUBTOTAL
Yes	**Maybe**		**6. MATERIALS**
		8 max	**6.1 Ingredient Transparency for Material Health** Install products that have publicly disclosed inventories characterized and screened to 1,000 ppm or better: • 1 point per 5 installed Declare or HPD products from at least three different product categories • 1 point per 2 installed Declare or HPD products in any of these categories: adhesives, sealants, windows • 1 point per each product with third-party verified HPD or third-party verified Declare label • 2 points per each product with third-party verified HPD or third-party verified Declare label in any of these categories: adhesives, sealants, windows
		3 max	**6.2 Recycled Content and Ingredient Transparency** Use building products that feature, and disclose, their recycled content. The building product must make up 75% by weight or cost of a project category for the project and be composed of at least 25% post-consumer recycled content.
		8 max	**6.3 Chemical Hazard Optimization** Install products that have third-party verification of optimization to 100 ppm or better per the options listed within the full criterion.

Yes	M	**6.4 Healthier Material Selection**
	15 max	Select all interior paints, coatings, primers, and wallpaper; interior adhesives and sealants; flooring; insulation; and composite wood as specified. Optional points also available.
	12 max	**6.5 Environmentally Responsible Material Selection**
		Select concrete, steel, or insulation with a publicly disclosed EPD *[3 points]* , Install a green or cool roof *[3 points]* , use reflective paving *[3 points]* , and/or use FSC certified wood *[3 points]* . Refer to criterion for specifics.
Yes	M	**6.6 Bath, Kitchen, Laundry Surfaces**
		(Mandatory for New Construction and Substantial Rehab. Moderate Rehabs that do not include work in the shower and tub areas are exempt from the shower and tub enclosure requirement.) Use materials that have durable, cleanable surfaces throughout bathrooms, kitchens, and laundry rooms. Use moisture-resistant backing materials per ASTM # D 6329 or 3273 behind tub/shower enclosures, apart from one-piece fiberglass enclosures which are exempt.
	4 max	**6.7 Regional Materials**
		Use products that were extracted, processed, and manufactured within 500 miles of the project for a minimum of 90%, based on weight or on cost, of the amount of the product category installed. Select any or all of these options (every two compliant materials can qualify for 1 point): • Framing Cladding (e.g. siding, masonry, roofing) • Flooring Concrete/cement and aggregate • Drywall/interior sheathing
Yes	M	**6.8 Managing Moisture: Foundations**
		(Mandatory for all New Construction projects and all Rehab projects with either basement and/or crawl space foundations) Install capillary breaks and vapor retarders that meet specified criteria appropriate for the foundation type.
Yes	M	**6.9 Managing Moisture: Roofing and Wall Systems**
		(Mandatory for all Rehab projects that include deficiencies in or include replacing particular assemblies called out below. New Construction projects are considered compliant per Criterion 5.1.) Provide water drainage away from walls, window, and roofs by implementing the list of techniques.
Yes	M	**6.10 Construction Waste Management**
	6 max	Develop and implement a waste management plan that reduces non-hazardous construction and demolition waste through recycling, salvaging, or diversion strategies through one of the three options. Achieve optional points by going above and beyond the requirement.

		2	**6.11 Recycling Storage** For projects with municipal recycling infrastructure and/or haulers, provide separate bins for the collection of trash and recycling for each dwelling unit and all shared community rooms. OR For projects without that infrastructure, advocate to the local waste hauler or municipality for regular collection of recyclables.
0	0		**6. MATERIALS SUBTOTAL**

Yes	Maybe		**7. HEALTHY LIVING ENVIRONMENT**
Yes		M	**7.1 Radon Mitigation** *(Mandatory for New Construction and Substantial Rehab)* For New Construction in EPA Zone 1 areas, install passive radon-resistant features below the slab and a vertical vent pipe with junction box within 10 feet of an electrical outlet in case an active system should prove necessary in the future. For Substantial Rehab projects in EPA Zone 1, test before and after the retrofit and mitigate per the specified protocols.
Yes		M	**7.2 Reduce Lead Hazards in Pre-1978 Buildings** *(Mandatory for Substantial Rehab of Buildings Constructed Before 1978)* Conduct lead risk assessment or inspection to identify lead hazards. Control identified lead hazards using lead abatement or interim controls, using lead-safe work practices that minimize and contain dust.
Yes		M	**7.3 Combustion Equipment** **For New Construction and Rehab projects:** Specify power-vented or direct-vent equipment when installing any new combustion appliance for space or water heating that will be located within the conditioned space. If there are any combustion appliances within the conditioned space, install one hard-wired carbon monoxide (CO) alarm with battery backup function for each sleeping zone, placed per National Fire Protection Association (NFPA) 72. **For Rehabs:** If there is any combustion equipment located within the conditioned space for space or water heating that is not power-vented or direct-vent and that is not scheduled for replacement, conduct combustion safety testing prior to and after the retrofit; remediate as indicated.
N/A		M	**7.4 Garage Isolation** • Provide a continuous air barrier between the conditioned space and any garage space to prevent the migration of any contaminants into the living space. Visually inspect common walls and ceilings between attached garages and living spaces to ensure that they are air-sealed before insulation is installed. • Do not install ductwork or air handling equipment for the conditioned space in a garage. • Fix all connecting doors between conditioned space and garage with gaskets or make airtight. • Install one hard-wired CO alarm with battery backup function for each sleeping zone of the project, placed per NFPA 72 unless the garage is mechanically ventilated or an open parking structure.
Yes		M	**7.5 Integrated Pest Management** Seal all wall, floor, and joint penetrations with low-VOC caulking or other appropriate nontoxic sealing methods to prevent pest entry.

			7.6 Smoke-Free Policy
Yes		M	**Mandatory:** Implement and enforce a smoke-free policy in all common areas and within a 25-foot perimeter around the exterior of all residential buildings. Lease language must prohibit smoking in these locations and provide a graduated enforcement policy. Make the smoke-free policy readily available.
10		10	**Optional:** Expand the policy above to include all indoor spaces in the property.
	6	M 12 max	**7.7 Ventilation** *(Mandatory for New Construction and Substantial Rehab; Optional for Moderate Rehab)* For each dwelling unit in full accordance with ASHRAE 62.2-2010, install: • A local mechanical exhaust system in each bathroom *[3 points if Moderate Rehab]* • A local mechanical exhaust system in each kitchen *[3 points if Moderate Rehab]* • A whole-house mechanical ventilation system *[3 points if Moderate Rehab]* Verify these flow rates are either within +/- 15 CFM or +/- 15% of design value. For each multifamily building of four or more stories, in full accordance with ASHRAE¬†62.1-2010, install: • A mechanical ventilation system for all hallways and common spaces *[3 points if Moderate Rehab]* For all project types, in addition to the above requirements: • All systems and ductwork must be installed per manufacturer's recommendations • All bathroom fans must be ENERGY STAR-labeled and wired for adequate run-time. • If using central ventilation systems with rooftop fans, each fan must be direct-drive and variable-speed with speed controller mounted near the fan. Fans with design CFM 300-2000 must also have an ECM motor.
N/A		M , 5	**7.8 Dehumidification** *(Mandatory for properties in Climate Zones 1A, 2A, 3A, and 4A following Criterion 5.2a, 5.2b, or 5.4. Optional for all other properties.)* **Option 1:** Design, select, and install supplemental dehumidification equipment to keep relative humidity OR **Option 2**: Equip all dwelling units with dedicated space, drain, and electrical hook-ups for permanent supplemental dehumidification systems to be installed if needed and install interior RH monitoring equipment as described.
		3	**7.9 Construction Pollution Management** **Option 1:** Earn the EPA Indoor airPlus label OR **Option 2:** In all dwelling units, seal all heating, cooling, and ventilation return and supply floor ducts and returns throughout construction to prevent construction debris from entering. Flush all dwelling units after completion of construction and prior to occupancy for either 48 hours or with at least 14,000 ft3 per ft2 of floor area, then replace all air handling equipment filters.

		3	**7.10 Noise Reduction** **Option 1:** Test and demonstrate that noise levels in bedrooms meet 30 dB LAeq (continuous) and 45 dB LAmax, (single sound). OR **Option 2:** Provide a noise abatement plan specific to the site covering general noise mitigation techniques in accordance with 24 CFR 51B. OR Option 3: Ensure all exterior wall and party wall penetrations are sealed with acoustical sealant, all party walls and floor/ceiling assemblies have an STC rating of at least 55, and exterior windows and doors in projects near a significant exterior noise source have an STC rating of at least 35
		8	**7.11 Active Design: Promoting Physical Activity** *(All projects must comply with at least one of either Criterion 7.11, 7.12, or 7.13. Points are not available for that criterion, but, are available for projects that meet two or three of these criteria.)* **Option 1:** Encouraging Everyday Stair Usage (buildings that include stairs as the only means to travel from one floor to another are not eligible for this option.) Provide a staircase that is accessible and visible from the main lobby and is visible within a 25-foot walking distance from any point in the lobby per the specifications listed. Place point-of-decision signage. OR **Option 2:** Activity Spaces. Provide on-site dedicated recreation space with exercise or play opportunities for adults and/or children that is open and accessible to all residents; see criterion for specifics.
Yes		8	**7.12 Beyond ADA: Universal Design** *(All projects must comply with at least one of either Criterion 7.11, 7.12, or 7.13. Points are not available for that criterion, but, are available for projects that meet two or three of these criteria.)* Select and implement at least one of the Options with at least three different strategies in at least 75% units. **Option 1:** Create welcoming and accessible spaces that encourage equitable use and social connections. **Option 2:** Create spaces that are easy and intuitive to use and navigate. **Option 3:** Promote safety and create spaces that allow for human error. **Option 4:** Create spaces that can be accessed and used with minimal physical effort. **Option 5:** Create spaces with the appropriate size and space to allow for use, whatever the user's form of mobility, size, or posture.
		8	**7.13 Healing-Centered Design** *(All projects must comply with at least one of either Criterion 7.11, 7.12, or 7.13. Points are not available for that criterion, but, are available for projects that meet two or three of these criteria.)* Select and implement at least two of the Options with at least two different strategies listed in at least 75% units. **Option 1:** Provide an environment that promotes feelings of real and perceived safety. **Option 2:** Create flexible spaces that allow for personalization and/or manipulation to meet individual and community needs. **Option 3:** Connect residents and staff to a living landscape and the natural environment. **Option 4:** Utilize art and culture in project design and programming and promote social connectedness.
10	6		**7. HEALTHY LIVING ENVIRONMENT SUBTOTAL**

Yes	Maybe		8. OPERATIONS, MAINTENANCE + RESIDENT ENGAGEMENT
Yes		M	**8.1 Building Operations & Maintenance Manual and Plan** *(For all Multifamily projects)* Develop a manual with thorough building operations and maintenance (O&M) guidance and a complementary plan. The manual and plan should be developed over the course of the project design, development, and construction stages, and should include sections/chapters addressing the list of topics.
Yes		M	**8.2 Emergency Management Manual** *(For all Multifamily projects)* Provide a manual on emergency operations targeted toward operations and maintenance staff and other building-level personnel. The manual should address responses to various types of emergencies, leading with those that have the greatest probability of negatively affecting the project. The manual should provide guidance as to how to sustain the delivery of adequate housing throughout an emergency and cover a range of topics, including but not limited to: • communication plans for staff and residents • useful contact information for public utility and other service providers • infrastructure and building, "shutdown" procedures • plan for regular testing of backup energy systems, if these exist
Yes		M	**8.3 Resident Manual** Provide a guide for homeowners and renters that explains the intent, benefits, use, and maintenance of their home's green features and practices. The Resident Manual should encourage green and healthy activities per the list of topics.
Yes		M	**8.4 Walk-Throughs and Orientations to Property Operation** Provide a comprehensive walk-through and orientation for all residents, property manager(s), and buildings operations staff.
Yes		M	**8.5 Energy and Water Data Collection and Monitoring** For rental properties, upload project energy and water performance data in an online utility benchmarking platform annually for at least five years from time of construction completion per one of the four methods provided; grant Enterprise view access for that period. For owner-occupied units, collect and monitor utility data in a manner that allows for easy access and review.
0	0		8. OPERATIONS, MAINTENANCE + RESIDENT ENGAGEMENT SUBTOTAL
38	**6**		**TOTAL**

ENERGY STAR Multifamily New Construction
National Rater Field Checklist [1], Version 1 / 1.1 / 1.2 (Rev. 04)

Building Name: Linn Street Exchange Number of Units: 62 Permit Date: _____

Building Address: 1510 Linn St City: Cincinnati State: OH

Thermal Enclosure System 1. High-Performance Fenestration & Insulation	Must Correct	Builder Verified [3]	Rater Verified [4]	N/A [5]
1.1 Fenestration meets or exceeds specification in Items 2.1 & 2.2 of the Natl Rater Design Review Checklist.	☐	☐	☐	-
1.2 Insulation meets or exceeds specification in Items 3.1 & 3.2 of the Natl Rater Design Review Checklist.	☐	Up to 10% ☐	☐	-
1.3 All insulation achieves Grade I install. per ANSI / RESNET / ICC 301. Alternatives in Footnote 6. [7]	☐	Up to 10% ☐	☐	-
1.4 Prescriptive Path: Window-to-wall ratio ≤ 30%. [8]	☐	☐	☐	☐
1.5 Heated plenums in unconditioned space or ambient conditions must meet the following requirements: [9]				
1.5.1 Sides of heated plenum are an air barrier and insulated to ≥ R-3ci in CZ 1-4; ≥ R-5ci in CZ 5-6; ≥ R-7.5ci in CZ 7; ≥ R-9.5ci in CZ 8, [10] **AND;**	☐	☐	☐	☐
1.5.2 Insulation at top of heated plenum meets Item 3.6 where applicable. Otherwise, meets or exceeds the R-value for mass floors from the "All Other" column of Table 502.2(1) of 2009 IECC, [10, 11] **AND;**	☐	☐	☐	☐
1.5.3 Bottom of heated plenum must have at least R-13 insulation. [11, 12]	☐	☐	☐	☐
1.6 Garages with space heating must meet the following requirements: [9]				
1.6.1 Insulation on above grade walls and walls on the first story below grade ≥ R-5ci in CZ 5-6; ≥ R-7.5ci in CZ 7; ≥ R-9.5ci in CZ 8, [10] **AND;**	☐	☐	☐	☐
1.6.2 Ceiling insulation meets Item 3.6 where applicable. Otherwise, meets or exceeds the R-value for mass floors from the "All Other" column of Table 502.2(1) of 2009 IECC. [10]	☐	☐	☐	☐
2. Fully-Aligned Air Barriers [13] At each insulated location below, a complete air barrier is provided that is fully aligned as follows:				
Ceilings: At interior or exterior horizontal surface of ceiling insulation in Climate Zones 1-3; at interior horizontal surface of ceiling insulation in Climate Zones 4-8. Also, at exterior vertical surface of ceiling insulation in all climate zones (e.g., using a wind baffle that extends to the full height of the insulation in every bay or a tabbed baffle in each bay with a soffit vent that prevents wind washing in adjacent bays). [10, 14]				
2.1 Dropped ceilings / soffits below unconditioned attics, chase / dead space, and all other ceilings.	☐	☐	☐	☐
Walls: At exterior vertical surface of wall insulation in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8. [10, 15]				
2.2 Walls behind showers, tubs, staircases, and fireplaces.	☐	☐	☐	☐
2.3 Architectural bump-outs, dead space, and all other exterior walls.	☐	☐	☐	-
Floors: At exterior vertical surface of floor insulation in all climate zones and, if over unconditioned space, also at interior horizontal surface including supports to ensure alignment. Alternatives in Footnotes 15 & 16. [16, 17, 18]				
2.4 Floors above garages, floors above unconditioned spaces, and cantilevered floors.	☐	☐	☐	☐
2.5 All other floors adjoining unconditioned space (e.g., rim / band joists at exterior wall or at porch roof).	☐	☐	☐	☐
3. Reduced Thermal Bridging				
3.1 For insulated ceilings with attic space above (i.e., non-cathedralized), Grade I insulation extends to the inside face of the exterior wall below and is ≥ R-21 in CZ 1-5; ≥ R-30 in CZ 6-8. [10, 19]	☐	☐	☐	☐
3.2 For insulated ceilings with attic space above, attic access panels and drop-down stairs insulated ≥ R-10 or equipped with durable ≥ R-10 cover. [20]	☐	☐	☐	☐
3.3 Insulation beneath attic platforms (e.g., HVAC platforms, walkways) ≥ R-21 in CZ 1-5; ≥ R-30 in CZ 6-8. [10]	☐	☐	☐	☐
3.4 For slabs on grade in CZ 4-8, 100% of slab edge insulated to ≥ R-5 at a depth of 2 ft., or 4 ft. for heated slabs in CZ 6-8, & aligned with the thermal boundary of the walls. [10, 21, 22]	☐	☐	☐	☐
3.5 For above-grade and at-grade concrete floor edges (e.g., podiums, balconies) in CZ 4-8, 100% of floor edge insulated to ≥ R-5 & aligned with the thermal boundary of the walls. At this boundary, concrete floors resting on mass walls must provide insulation that extends ≥8 ft. below the bottom of the floor edge & for floors resting on columns, insulation must surround the column, at a depth of 4ft. Alternatives in Fn. 24.[10,23]	☐	☐	☐	☐
3.6 For concrete slab floors in CZ 4-8 above ambient conditions, garages, or unconditioned spaces outside the thermal boundary, floor insulation meets the U-factor specified in Table 502.1.2 of the 2009 IECC for Group R when dwelling units are above the slab, & 'All Other' when common space is above the slab. [10, 25]	☐	☐	☐	☐
3.7 At above-grade walls and rim / band joists separating conditioned space from the exterior, one of the following options used: [26, 27]				
3.7.1 Continuous rigid insulation, insulated siding, or combination of the two is: ≥ R-3 in CZ 1-4; ≥ R-5 in CZ 5-8 [10, 27, 28, 29, 30], **OR**;	☐	☐	☐	☐
3.7.2 Structural Insulated Panels **OR**; Insulated Concrete Forms **OR**; Double-wall framing **OR**; [27, 28, 31]	☐	☐	☐	☐
3.7.3 For wood-framed walls in CZ 1-5 (all stories) & in CZ 6-8 (≤3 stories) only: 'advanced framing' details including all Items below: [27, 32]				
3.7.3a Corners insulated ≥ R-6 to edge [33], **AND**;	☐	☐	☐	☐
3.7.3b Headers above windows & doors insulated ≥ R-3 for 2x4 framing or equivalent cavity width, and ≥ R-5 for all other assemblies (e.g., with 2x6 framing) [34], **AND**;	☐	☐	☐	☐
3.7.3c Interior / exterior wall intersections insulated to same R-value as rest of exterior wall. [35]	☐	☐	☐	☐
3.7.3d In CZ 4C and 5, for > 3 stories, ≥ 5.5" framing depth used with wall cavity insulated ≥R-20.0.	☐	☐	☐	☐

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4. Air Sealing (Unless otherwise noted below, "sealed" indicates the use of caulk, foam, or equivalent material.)	**Must Correct**	**Builder Verified [3]**	**Rater Verified [4]**	**N/A [5]**
The following items must be verified in dwelling units and common spaces to reduce air leakage to exterior, adjacent buildings, or unconditioned spaces.				
4.1 Ducts, flues, shafts, plumbing, piping, wiring, exhaust fans, & other penetrations to unconditioned space sealed, with blocking / flashing as needed.	☐	☐	☐	-
4.2 Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 in CZ 4-8. [10]	☐	☐	☐	☐
4.3 Continuous top plate or blocking is at top of walls adjoining unconditioned space including at balloon-framed parapets, and sealed.	☐	☐	☐	☐
4.4 Drywall sealed to top plate at all unconditioned attic / wall interfaces using caulk, foam, drywall adhesive (but not other construction adhesives), or equivalent material. Either apply sealant directly between drywall and top plate or to the seam between the two from the attic above.	☐	☐	☐	☐
4.5 Rough opening around windows & exterior doors sealed. [36]	☐	☐	☐	-
4.6 Assemblies that separate attached garages from occupiable space sealed and, also, an air barrier installed, sealed, and aligned with these assemblies. [37]	☐	☐	☐	☐
4.7 Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions made substantially air-tight with door seal and weatherstripping or equivalent gasket.	☐	☐	☐	☐
4.8 Attic access panels, roof hatches and drop-down stairs are gasketed (i.e., not caulked) or equipped with durable covers that are gasketed. [20]	☐	☐	☐	☐
The following items must be additionally verified in dwelling units, to reduce air leakage between conditioned spaces.				
4.9 Doors serving as a unit entrance from a corridor/stairwell made substantially air-tight with door seal and weatherstripping or equivalent gasket.	☐	☐	☐	☐
4.10 Rater-measured compartmentalization is no greater than 0.30 CFM50 per square feet of dwelling unit enclosure area, following procedures in ANSI / RESNET / ICC 380. [38]	☐	-	☐	
4.10.1 For dwelling units with forced air distribution systems without ducted returns and air handlers located in a closet or space adjacent to unconditioned space, the Rater-measured pressure difference between the space containing the air handler and the conditioned space during the compartmentalization test is no greater than 5 Pa. [39]	☐	-	☐	☐

HVAC System [40]		**Must Correct**	**Rater Verified [4]**	**N/A [5]**
5. Heating & Cooling Eqpt. Complete Track A - HVAC Grading by Rater [41] or Track B - HVAC Testing by FT Agent [42]				
Track A	5a.1 Blower fan volumetric airflow is Grade I or II per ANSI / RESNET / ACCA 310	☐	☐	☐
	5a.2 Blower fan watt draw is Grade I or II per ANSI / RESNET / ACCA 310	☐	☐	☐
	5a.3 Refrigerant charge is Grade I per ANSI / RESNET / ACCA 310. See Footnote 43 for exemptions.	☐	☐	☐
	5a.4 HVAC manufacturer & model number on installed equipment matches the HVAC Design Report in compliance with ANSI / RESNET / ACCA 310 or the HVAC Design Supplement to Std. 310 for Common Spaces and Central Systems. [44]	☐	☐	☐
Track B	5b.1 HVAC manufacturer & model number on installed equipment matches either of the following (check box):[45] ☐ National HVAC Design Report (4.6-4.9 & 4.25-4.26) ☐ Written approval received from designer	☐	☐	-
	5b.2 External static pressure measured by Rater at contractor-provided test locations and documented below: [46] Return-Side External Static Pressure: _____ IWC Supply-Side External Static Pressure: _____ IWC	☐	☐	☐
5.5 Prescriptive Path: Heating and cooling equipment serving dwelling units, common spaces, and garages meet the efficiency levels specified in the Exhibit X. Electric resistance space heating is not installed in dwelling units. [47]		☐	☐	☐
5.6 ERI Path: Heating and cooling equipment serving common spaces and garages, but not serving dwelling units, meet the efficiency levels specified in the Exhibit X. See Exhibit X for restrictions on electric resistance space heating. [47]		☐	☐	☐
5.7 National HVAC Functional Testing Checklist(s) collected prior to certification, with all HVAC systems in the building fully documented. Exception: Where credentialed HVAC Contractor(s) are completing the National HVAC Functional Testing Checklist, the checklist is not required to be collected for the systems they verify. [48]		☐	☐	☐
5.8 Rater has verified and documented that Functional Testing Agent(s) ("FT Agent(s)") completing the National HVAC Functional Testing Checklist(s) hold one of the required credentials and completed orientation, if applicable. [48] Credential(s): _____ FT Agent Name(s): _____		☐	☐	☐

Equipment Controls	**Must Correct**	**LP Verified [49]**	**Rater Verified [4]**	**N/A [5]**
5.9 All heating and cooling systems serving a dwelling unit have thermostatic controls within the dwelling unit.	☐	-	☐	☐
5.9.1 Prescriptive Path: Dwelling unit thermostats are programmable.	☐	-	☐	☐
5.10 Where present, stair and elevator shaft vents are equipped with motorized dampers that are capable of being automatically closed during normal building operation and are interlocked to open as required by fire and smoke detection systems. Dampers are verified to be closed at the time of inspection.	☐	☐	☐	☐

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Equipment Controls (Continued)	Must Correct	LP Verified[49]	Rater Verified [4]	N/A [5]
5.11 Freeze protection systems, such as heat tracing of piping and heat exchangers, including self-regulating heat tracing, and garage / plenum heaters include automatic controls that are verified to shut off the systems when pipe wall or garage / plenum temperatures are above 40°F.	☐	☐	☐	☐
5.11.1 Where heat tracing is installed for freeze-protection, controls must be based on pipe wall temperature and a minimum of R-3 pipe insulation is also required.	☐	☐	☐	☐
5.12 Snow- and ice-melting systems include automatic controls that are verified to shut off the systems when the pavement temperature is above 50°F and no precipitation is falling, and an automatic or manual control is installed that is verified to shut off system when the outdoor temperature is above 40°F, so that the potential for snow or ice accumulation is negligible.	☐	☐	☐	☐
Hydronic Distribution Requirements – Applies to heating or cooling systems serving more than one dwelling unit				
5.13 For hydronic distribution systems, all terminal heating and cooling distribution equipment are separated from the riser or distribution loop by a control valve or terminal distribution pump, so that heated or cooled fluid is not delivered to the dwelling unit distribution equipment when there is no call from the thermostat.	☐	☐	☐	☐
5.14 Terminal units in hydronic distribution systems are equipped with pressure independent balancing valves or pressure independent control valves.	☐	☐	☐	☐
5.15 Piping of a heating or cooling system is insulated in accordance with Item 4.42 on the National HVAC Design Report, including where passing through planks or any other penetrations.	☐	☐	☐	☐
5.16 For circulating pumps serving hydronic heating or cooling systems with three-phase motors, 1 horse-power or larger, motors meet or exceed efficiency standards for NEMA Premium™ motors. If 5 horse-power or larger, also installed with variable frequency drives.	☐	☐	☐	☐
6. Duct Quality Installation – *Applies to Heating, Cooling, Ventilation, Exhaust, & Pressure Balancing Ducts, Unless Noted in Footnote.*	**Must Correct**		**Rater Verified [4]**	**N/A [5]**
6.1 Ductwork installed without kinks, sharp bends, compressions, or excessive coiled flexible ductwork. [50]	☐		☐	☐
6.2 All bedrooms provided with transfer grilles, jump ducts, dedicated return ducts, and/or undercut doors. Bedrooms with a design supply airflow ≥ 150 CFM (per Item 5.2 on the National HVAC Design Report) achieve a Rater-measured pressure differential ≥ -5 Pa and ≤ +5 Pa with respect to the main body of the dwelling unit when all air handlers are operating. Townhouses only: In addition, bedrooms with a design supply airflow < 150 CFM achieve a Rater-measured pressure differential ≥ - 3 Pa and ≤ +3 Pa. See Footnote 51 for test configuration.	☐		☐	☐
6.3 All supply and return ducts in unconditioned space, including connections to trunk ducts, are insulated to ≥ R-6. [52]	☐		☐	☐
6.3.1 Prescriptive Path: Dwelling unit ductwork meets the location and insulation requirements specified in the ENERGY STAR Multifamily Reference Design.	☐		☐	☐
6.4 Rater-measured total duct leakage in dwelling units (and common spaces using ANSI / RESNET / ACCA 310) meets one of the following: [53, 54]				
6.4.1 Rough-in: Tested per allowances below, with air handler & all ducts, building cavities used as ducts, & duct boots installed. In addition, all duct boots sealed to finished surface, Rater-verified at final. [55] No ducted returns [39]: The greater of ≤ 3 CFM25 per 100 sq. ft. of CFA or ≤ 30 CFM. Additionally, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton. One or two ducted returns [39]: The greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM. Three or more ducted returns [39]: The greater of ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM.	☐		☐	☐
6.4.2 Final: Tested per allowances below, with the air handler & all ducts, building cavities used as ducts, duct boots, & register grilles atop the finished surface (e.g., drywall, floor) installed. [56] No ducted returns [39]: The greater of ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM. Additionally, the Rater-measured pressure difference between the space containing the air handler and the conditioned space, with the air handler running at high speed, is ≤ 5 Pa. For systems > 1 ton, increase by 1 Pa per half ton. One or two ducted returns [39]: The greater of ≤ 8 CFM25 per 100 sq. ft. of CFA or ≤ 80 CFM. Three or more ducted returns [39]: The greater of ≤ 12 CFM25 per 100 sq. ft. of CFA or ≤ 120 CFM.	☐		☐	☐
6.5 Townhouses only: Rater-measured duct leakage to the outside the greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25. [53, 57]	☐		☐	☐
6.6 Common Space: Supply, return, and exhaust ductwork and all plenums serving common spaces are sealed at all transverse joints, longitudinal seams, and duct wall penetrations with mastic, mastic tape, or internal aerosol-based sealant.	☐		☐	☐
6.7 Duct leakage of central exhaust ductwork serving four or more dwelling units, meets one of the following two options:				
6.7.1 Rough-in: Tested including horizontal run outs, trunks, branches, and take-offs up to, but not including the grilles, the leakage does not exceed 25% of exhaust fan flow. [58]	☐		☐	☐
6.7.2 Final: Tested inclusive of all ductwork between the fan and the grilles, the leakage does not exceed 30% of exhaust fan flow. [58]	☐		☐	☐

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7. Dwelling-Unit & Common Space Mechanical Vent. Systems ("Vent Systems") [59] & Inlets in Return Duct [60] (National HVAC Design Report Item # indicated in parenthesis)	**Must Correct**	**Rater Verified [4]**	**N/A [5]**
7.1 Ventilation manufacturer & model number on installed equipment matches either of the following (check box): [45] ☐ National HVAC Design Report ☐ Written approval received from designer	☐	☐	-
7.2 Rater-measured ventilation rate is within either ± 15 CFM or ±15% of dwelling unit design values (2.7), and meets or exceeds rates required by ASHRAE 62.2-2010. [61]	☐	☐	-
7.3 Measured ventilation rate is within either ± 15 CFM or ±15% of common space design values (2.9), and meets or exceeds rates required by ASHRAE 62.1-2010 (2.8). [62, 63]	☐	☐	☐
7.4 A ventilation override control installed and also labeled if its function is not obvious (e.g., a label is required for a toggle wall switch, but not for a switch that's on the ventilation equipment). Townhouses only: In addition, the ventilation override control installed must be readily-accessible to the occupant.	☐	☐	-
7.5 For any outdoor air inlet connected to a ducted return of the dwelling unit HVAC system (Complete if present; otherwise check "N/A"): [60]			☐
7.5.1 Controls automatically restrict airflow using a motorized damper during vent. Off-cycle and occupant override. [64]	☐	☐	-
7.5.2 Rater-measured vent. Rate is ≤ 15 CFM or 15% above design value at highest HVAC fan speed. Alt. in Fn. 65. [65]	☐	☐	-
7.6 If located in the dwelling unit, system fan rated ≤ 3 sones if intermittent, ≤ 2 sones if continuous, or exempted. [66]	☐	☐	-
7.7 If dwelling-unit Vent System controller operates the dwelling unit HVAC fan, then HVAC fan operation is intermittent and either the fan type is ECM / ICM (4.12), or the controls will reduce the run-time by accounting for HVAC system heating or cooling hours. [67]	☐	☐	☐
7.8 In-unit bathroom fans or in-line fans are ENERGY STAR certified if used as part of the dwelling-unit mechanical ventilation system. [68]	☐	☐	☐
7.9 If central exhaust fans, ≤ 1 HP, are installed as part of the dwelling-unit mechanical ventilation system, then they are direct-drive, ECM, with variable speed controllers. If > 1 HP, their motors meet or exceed efficiency standards for NEMA Premium ™ motors. [69]	☐	☐	☐
7.10 Air inlet locations (Complete if ventilation air inlet locations were installed (2.23, 2.24); otherwise check "N/A"): [70, 71]	-	-	☐
7.10.1 Inlet(s) pull ventilation air directly from outdoors and not from attic, crawlspace, garage, or adjacent dwelling unit.	☐	☐	-
7.10.2 Inlet(s) are ≥ 2 ft. above grade or roof deck; ≥ 10 ft. of stretched-string distance from known contamination sources not exiting the roof, and ≥ 3 ft. distance from dryer exhausts and sources exiting the roof. [72]	☐	☐	-
7.10.3 Inlet(s) are provided with rodent / insect screen with ≤ 0.5 inch mesh.	☐	☐	-

8. Local Mechanical Exhaust (National HVAC Design Report Item # indicated in parenthesis)

Dwelling Unit Mechanical Exhaust – In each dwelling unit kitchen and bathroom, a system is installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow and manufacturer-rated sound level standards: [59, 73]

Location		**Continuous Rate**	**Intermittent Rate [74]**	**Must Correct**	**Rater Verified [4]**	**N/A [5]**
8.1 Kitchen	Airflow	≥ 5 ACH, based on kitchen volume [75, 76] (Alternative in Fn. 75)	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [75, 76, 77]	☐	☐	-
	Sound	Recommended: ≤ 1 sone	Recommended: ≤ 3 sones			
8.2 Bathroom	Airflow	≥ 20 CFM	≥ 50 CFM	☐	☐	-
	Sound	Required: ≤ 2 sones	Recommended: ≤ 3 sones			

Mechanical Exhaust for Common Spaces [2] and Shared Garages			
8.3 Measured exhaust rates are ≥ ASHRAE 62.1-2010 rates (2c). [62]	☐	☐	☐
8.4 Where an exhaust system is installed in a shared garage, it is equipped with controls that sense CO and NO2.	☐	☐	☐
9. Filtration			
9.1 MERV 6+ filter(s) installed in each ducted mechanical system serving an individual dwelling unit, designed so all return and mechanically supplied outdoor air passes through filter(s) prior to conditioning, and located to facilitate access & regular service by the occupant, building owner, or building maintenance staff. [78]	☐	☐	☐
9.1.1 Filter access panel includes gasket and fits snugly against the exposed edge of filter when closed to prevent bypass. [79]	☐	☐	☐
10. Combustion Appliances			
10.1 Furnaces, boilers, and water heaters located within the building's pressure boundary are mechanically drafted or direct-vented. Alternatives in Footnote 82. [80, 81]	☐	☐	☐
10.2 Fireplaces located within the building's pressure boundary are direct-vented. [80, 81]	☐	☐	☐
10.3 No unvented combustion appliances other than cooking ranges or ovens are located inside the building's pressure boundary. [80]	☐	☐	☐

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Other	Must Correct	LP Verified[49]	Rater Verified [4]	N/A [5]
11. Domestic Hot Water				
11.1 Prescriptive Path: Hot Water Equipment Minimum Efficiency Levels (must meet one of the following):				
11.1.1 Where rated in EF or UEF, meet or exceed the ENERGY STAR Multifamily Reference Design [83]	☐	-	☐	☐
11.1.2 Where rated in Et or COP:				
11.1.2a For all Versions except Nat'l v1.2, ≥ 95% Et if electric and ≥ 85% Et for other fuels.	☐	-	☐	☐
11.1.2b For Nat'l v1.2, ≥ 2.0 COP for electric serving dwelling units, ≥ 95% Et for electric serving common spaces, and ≥ 90% Et for other fuels.	☐	-	☐	☐
11.2 ERI Path: Hot Water Equipment Min. Efficiency Levels for equipment serving common spaces but not dwelling units nor shared laundry:				
11.2.1 For non-electric equipment: if rated in EF or UEF, meet the efficiency levels specified in the ENERGY STAR Multifamily Reference Design; if rated in Et ≥85%, or for Nat'l v1.2 ≥ 90%. [83]	☐	-	☐	☐
11.2.2 For electric equipment: ≥ 0.93 UEF, 0.95 EF or 95% Et. [83]	☐	-	☐	☐
12. Lighting				
12.1 Common Space [2] Lighting Controls:				
12.1.1 ERI and Prescriptive Path: All common spaces [2] (including shared garages), except the building lobby, mechanical equipment rooms, and where automatic shutoff would endanger the safety of occupants [84], have occupancy sensors, programmed timers, or automatic bi-level lighting controls installed and operation has been verified.	☐	☐	☐	☐
12.1.2 ASHRAE Path only: All common spaces [2] (including shared garages), except the building lobby, mechanical equipment rooms, corridors, and stairwells and where automatic shutoff would endanger the safety of occupants [84], have occupancy sensors or automatic bi-level lighting controls installed and operation has been verified.	☐	☐	☐	☐
12.2 Exterior lighting controls: Fixtures, including parking lot fixtures, must include automatic switching on timers or photocell controls except fixtures intended for 24-hour operation, required for security, or associated with the electric meter for an individual dwelling unit.	☐	☐	☐	☐
12.3 Common Spaces [2] and Garages: 90% of installed lighting fixtures are integrated LED fixtures or contain LED lamps. See Footnote 85 for alternate options.	☐	☐	☐	☐
12.4 ERI Path: All exterior and common space lighting fixtures meet the efficiency requirements in the ENERGY STAR Multifamily Reference Design, except fixtures located on dwelling unit balconies. [88, 89]	☐	-	☐	☐
12.5 Prescriptive Path: All lighting fixtures (i.e., dwelling units, common spaces, and exterior) meet the efficiency requirements in the ENERGY STAR Multifamily Reference Design. [88, 89]	☐	-	☐	☐
12.6 Prescriptive Path: Dwelling unit overall in-unit lighting power density ≤ 0.75 W/ft^2. When calculating overall lighting power density, use 1.1 W/ft^2 where lighting is not installed. [86]	☐	-	☐	☐

13. Appliances and Plumbing Fixtures	Must Correct	Rater Verified [4]	N/A [5]
13.1 Prescriptive Path: Installed appliances are ENERGY STAR certified. Installed bathroom faucets, bathroom aerators, and showerheads are WaterSense labeled. [90]	☐	☐	☐
13.2 ERI Path: Where installed in common spaces, refrigerators and dishwashers are ENERGY STAR certified and showerheads are WaterSense labeled.	☐	☐	☐
13.3 Prescriptive Path: Shower compartments with multiple fixtures cannot be operated simultaneously OR the total flow rate per shower compartment must not exceed 1.75 gallons per minute, as rated at 80 psi.	☐	☐	☐
14. Whole Building Energy Consumption Data Acquisition Strategy			
14.1 For buildings 50,000 ft^2 and larger, a strategy that enables the collection of monthly or annual building-level energy consumption data (electricity, natural gas, chilled water, steam, fuel oil, propane, etc.) has been confirmed. [91]	☐	☐	☐

Rater Name: _____ Rater Pre-Drywall Inspection Date(s):[92] _____ Rater Initials: _____

Rater Company Name: _____

Rater Name: _____ Rater Final Inspection Date(s)[93]: _____ Rater Initials: _____

Rater Company Name: _____

Builder/Developer Employee: _____ Builder Inspection Date(s): _____ Builder Initials: _____

Builder/Developer Name: _____

Licensed Professional: _____ LP Inspection Date(s): _____ LP Initials: _____

Footnotes:

1. This Checklist applies to all dwelling units, sleeping units, common spaces [2], and garages (open or enclosed) in the building being certified, and where specified, parking lots. These requirements apply to all Paths, unless otherwise specified. These requirements do not apply to parking garages or lots where the cost of the energy use of the parking garage or lot is not the responsibility of the Builder/Developer, Building Owner or Property Manager. This Checklist does not apply to commercial or retail spaces. This Checklist does not apply to common spaces [2] that are located in buildings on the property without any dwelling or sleeping units. A 'sleeping unit' as defined by ANSI / RESNET / ICC 301, is a room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Where the term 'dwelling unit' is used in this Checklist, the requirement is also required of 'sleeping' units. The term 'building' refers to a structure that encompasses dwelling/sleeping units and (if present) common spaces, sharing one or more of the following attributes: a common street address, a common entrance or exit, central/shared mechanical systems, or structurally interdependent wall or roof systems. Attached structures such as townhouses and 4-story two-unit structures (commonly referred to as "2-over-2s") may be considered separate buildings if they are divided by a vertical fire separation wall from the foundation to the roof sheathing and share none of the other attributes listed above. A skyway or a breezeway that connects two structures is not considered a common entrance or exit.
2. The term 'common space' refers to any spaces in the building being certified that serve a function in support of the residential part of the building that is not part of a dwelling or sleeping unit. This includes spaces used by residents, such as corridors, stairs, lobbies, laundry rooms, exercise rooms, residential recreation rooms, and dining halls, as well as offices and other spaces used by building management, administration or maintenance in support of the residents.
3. At the discretion of the Rater, the builder or developer may verify up to eight items in Sections 1-4 of this Checklist. For the purpose of this Checklist, "Builder" represents either the builder or the developer. When this allowance is used for Item 1.2 or 1.3, a maximum of 10% of the total surface area of the non-adiabatic insulated assemblies are permitted to be builder-verified; the remainder must be verified by the Rater. When exercised, the builder's responsibility will be formally acknowledged by the builder, or their designated agent, signing off on the checklist for the item(s) that they verified. However, if a quality assurance review indicates that Items have not been successfully completed, the Rater will be responsible for facilitating corrective action.
4. The term 'Rater' refers to the person(s) completing the third-party verification required for certification. The person(s) shall: a) be a Certified Rater, Approved Inspector, as defined by ANSI / RESNET / IECC 301, or an equivalent designation as determined by a Home Certification Organization (HCO) or Multifamily Review Organization (MRO); and, b) have attended and successfully completed an EPA-recognized training class. See www.energystar.gov/mftraining.

   As stated in the National Program Requirements, for Townhouses, all items shall be verified for each certified home and sampling protocols shall not be used. For other multifamily building types, Raters who operate under an MRO or an HCO Sampling Protocol are permitted to verify any Checklist Item designated "Rater Verified" using an MRO or HCO-approved sampling protocol. No parties other than Raters are permitted to use sampling to complete this Checklist.
5. The column titled "N/A," which denotes items that are "not applicable," should be used when the checklist Item is not present in the building or conflicts with local requirements.
6. Two alternatives are provided: a) Grade II cavity insulation is permitted to be used for assemblies that contain a layer of continuous, air impermeable insulation ≥ R-3 in Climate Zones 1 to 4, ≥ R-5 in Climate Zones 5 to 8; [10] b) Grade II batts are permitted to be used in floors if they fill the full width and depth of the floor cavity, even when compression occurs due to excess insulation, as long as the R-value of the batts has been appropriately assessed based on manufacturer guidance and the only defect preventing the insulation from achieving Grade I is the compression caused by the excess insulation.
7. Ensure compliance with this requirement using ANSI / RESNET / ICC 301 including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the schedule defined by the HCO or MRO that the building is certified under, with approved exceptions listed at www.energystar.gov/ERIExceptions.
8. Window-to-Wall ratio is taken as the sum of all window area divided by the total exterior above-grade wall area. All decorative glass and skylight window area contribute to the total window area to above-grade wall ratio (WWR). Spandrel sections of curtain wall systems contribute to the above-grade wall area.
9. Compliance with Items 1.5 and 1.6 is not required for buildings pursuing the ASHRAE Path, but the energy used by the heating systems must be modeled following the requirements in the Simulation Guidelines, available at www.energystar.gov/mfguidance.
10. For all Versions except National v1.2, the 2009 IECC Climate Zone designations are applicable, as defined and illustrated in Section R301 of the code. For National v1.2, the 2021 IECC Climate Zone designations are applicable, as defined and illustrated in Section R301 of the code. Note that some locations have shifted to a different Climate Zone in the 2021 IECC compared to prior editions.
11. Where conditioned space is above the plenum, in lieu of insulating the top of the plenum, the bottom of the plenum may be used to comply with Items 1.5.2 and 1.5.3, if its insulation meets the requirements of Item 1.5.2 and, where applicable, Item 3.6. When using this alternative, the bottom of the plenum must meet all the requirements for floor insulation which include a fully-aligned air barrier as described in Footnote 13 and Grade I installation per Item 1.3.
12. The bottom of the heated plenum is permitted to be suspended ceiling tiles or other non-air barrier material. If fiberglass insulation is installed, it must be paper-faced. This insulation shall achieve a Grade I or Grade II install.
13. For purposes of this Checklist, an air barrier is defined as any durable solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. EPA recommends, but does not require, rigid air barriers.

    Open-cell or closed-cell foam shall have a finished thickness ≥ 5.5 in. or 1.5 in., respectively, to qualify as an air barrier unless the manufacturer indicates otherwise.

    If flexible air barriers such as house wrap are used, they shall be fully sealed at all seams and edges and supported using fasteners with caps or heads ≥ 1 in. diameter unless otherwise indicated by the manufacturer. Flexible air barriers shall not be made of kraft paper, paper-based products, or other materials that are easily torn. If polyethylene is used, its thickness shall be ≥ 6 mil.

14. All insulated ceiling surfaces, regardless of slope (e.g., cathedral ceilings, tray ceilings, conditioned attic roof decks, flat ceilings, sloped ceilings), must meet the requirements for ceilings, unless the ceiling is adiabatic.
15. All insulated vertical surfaces are considered walls (e.g., above and below grade exterior walls, knee walls) and must meet the air barrier requirements for walls. The following exceptions apply: air barriers recommended, but not required, in adiabatic walls; and, in Climate Zones 4 through 8, an air barrier at the interior vertical surface of insulation is recommended but not required in basement walls or crawlspace walls. For the purpose of these exceptions, a basement or crawlspace is a space for which ≥ 40% of the total gross wall area is below-grade.
16. EPA highly recommends, but does not require, an air barrier at the interior vertical surface of floor insulation in Climate Zones 4-8. [10]
17. Examples of supports necessary for permanent contact include staves for batt insulation or netting for blown-in insulation. Alternatively, supports are not required if batts fill the full depth of the floor cavity, even when compression occurs due to excess insulation, as long as the R-value of the batts has been appropriately assessed based on manufacturer guidance and the only defect preventing the insulation from achieving the required installation grade is the compression caused by the excess insulation.
18. Alternatively, an air barrier is permitted to be installed at the exterior horizontal surface of the floor insulation if the insulation is installed in contact with this air barrier, the exterior vertical surfaces of the floor cavity are also insulated, and air barriers are included at the exterior vertical surfaces of this insulation.
19. The minimum designated R-values must be achieved regardless of the trade-offs determined using an equivalent U-factor or UA alternative calculation. Note that if the minimum designated values are used, then higher insulation values may be needed elsewhere to meet Item 1.2. Also, note that these requirements can be met by using any available strategy, such as a raised-heel truss, alternate framing that provides adequate space, and / or high-density insulation.
20. Examples of durable covers include, but are not limited to, pre-fabricated covers with integral insulation, rigid foam adhered to cover with adhesive, or batt insulation mechanically fastened to the cover (e.g., using bolts, metal wire, or metal strapping. Low-slope roof hatch covers to be insulated to R-5 minimum.
21. Slab edge insulation is required for slab-on-grade floors with a floor surface less than 24 inches below grade. Slab perimeter insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of an interior, or exterior, slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall. The following alternatives apply:
    a. Slab assemblies with an F-Factor equivalent to that of the insulation required in Item 3.4 may be used. F-Factors shall be determined using Table A6.3.1-1 from ASHRAE 90.1-2022 Appendix A. See www.energystar.gov/F-Factor for more details.
    b. The thermal break is permitted to be created using ≥ R-3 rigid insulation on top the slab. In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).
22. Where an insulated wall separates a garage, patio, courtyard, porch, or other unconditioned space from the conditioned space of the building, slab perimeter insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab, if the slab is in contact with the ground, ambient, or unconditioned space at that interface. Where specific details cannot meet this requirement, partners shall provide the detail to EPA to request an exemption prior to the building's certification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted and non-exempted details is available at: www.energystar.gov/slabedge. If an exemption is used, then the Total UA Compliance option (5c) within the Multifamily Workbook must be used to demonstrate compliance with Item 1.2 if the ASHRAE Path or Prescriptive Path is used, and may be used to demonstrate compliance if the ERI Path is used. F-Factors shall be determined using Table A6.3.1-1 from ASHRAE 90.1-2022 Appendix A. See www.energystar.gov/F-Factor for more details.
23. Item 3.5 does not apply to the repeated concrete floor perimeter edges of a multistory building as those are subject to Item 3.7.1. Item 3.5 also does not apply where floor insulation meeting the requirements of Item 3.6 is installed above the slab and provides a continuous thermal boundary where it intersects the wall..
24. For the following podium constructions, a minimum of 8ft insulation is not required below the floor edge:
    a) Where podium wall is less than 8ft in height, insulation must instead be installed for the full height of the podium.
    b) For podiums that are at-grade or continue below-grade, insulate to a minimum of 8ft below the bottom of the slab edge, or a depth of 2ft., or 4 ft. for heated slabs in CZ 6-8, below-grade.
    c) Where a minimum of 4ft of insulation is installed on both interior and exterior surfaces of the wall.
    d) For podiums where the horizontal slab is not in direct contact with the exterior wall and R-5 insulation is provided at the slab edge, continuous with the under-slab insulation. See www.energystar.gov/slabedge for example.

    EPA has developed the following alternatives to comply with Item 3.5, instead of installing the insulation required:

    a) Projected concrete floors may use one of the options below:
        i. Install minimum R-2 insulation at the floor edge between conditioned space and the projected slab, AND:
            a. ASHRAE and Prescriptive Paths: Use the Total UA Compliance option (5c) within the Multifamily Workbook to demonstrate compliance with Item 1.2 and include a row that represents the floor edge.
            b. ERI Path: Model the floor edge using the R-value of the insulation provided (e.g., not the R-value of above-grade wall).
        ii. Install minimum R-5 insulation, above and below the concrete slab that extends horizontally for a minimum of 4 ft. Insulation installed on top of slab shall be covered by a durable floor surface. See www.energystar.gov/slabedge for example. When demonstrating compliance with Item 1.2, R-1 insulation may be associated with the area of the wall that is uninsulated due to the projected slab.
    b) All podiums and projected concrete floors, in lieu of installing the insulation required in Item 3.5, meet all of the following requirements:

i. Use the Total UA Compliance option (5c) within the Multifamily Workbook to demonstrate compliance with Item 1.2 and use the following U-factors:
   a. Where the above grade wall is in contact with a concrete floor above conditioned space, include a row that represents the floor-edge condition using a U-Factor of 1.20.
   b. Where the above grade wall is in contact with a concrete floor above unconditioned space, include a row that represents the floor-edge condition using a U-Factor of 1.64.

ii. Where using the ASHRAE or ERI Paths, in the energy model the concrete floor edge area must be modeled with R-0.

25. While EPA recommends insulating interior columns for a minimum of R-5 for 4 vertical feet and vertically along other areas of discontinuity, such as where walls intersect the concrete slab; this is not required.

26. Item 3.7 is applicable to walls that are adjacent to other buildings. Mass walls utilized as the thermal mass component of a passive solar design (e.g., a Trombe wall) are exempt from this Item. To be eligible for this exemption, the passive solar design shall be comprised of the following five components: an aperture or collector, an absorber, thermal mass, a distribution system, and a control system. For more information, see: www.energy.gov/sites/prod/files/guide_to_passive_solar_home_design.pdf.

    Mass walls that are not part of a passive solar design (e.g., CMU block or log home enclosure) shall either utilize the strategies outlined in Item 3.7 or the pathway in the assembly with the least thermal resistance, as determined using a method consistent with the 2013 ASHRAE Handbook of Fundamentals, shall provide ≥ 50% of the applicable assembly resistance, defined as the reciprocal of the mass wall equivalent U-factor in the 2009 IECC Table 502.1.2. Documentation identifying the pathway with the least thermal resistance and its resistance value shall be collected by the Rater and any Builder Verified or Rater Verified box under Item 3.7 shall be checked.

27. Walls and rim / band joists using steel or other metal framing shall meet the reduced thermal bridging requirements by complying with Item 3.7.1 of the Checklist and may not demonstrate compliance using Item 3.7.2 or 3.7.3.

28. Up to 10% of the total exterior wall surface area is exempted from the reduced thermal bridging requirements to accommodate intentionally designed details. This exemption does not apply to steel columns or the repeated concrete floor perimeter edges of a multistory building. To calculate the exempted wall area, the Rater shall sum the areas of the following features that either prevent the use of, or interrupt, continuous insulation when they are present in the design: architectural details (e.g., wing walls, shading devices, roof overhangs, projected balconies, brick returns, stone window sills, metal panels, or masonry fireplaces); cladding details (e.g., non-thermally broken shelf angles, metal clips, metal brackets, and metal z-girts; but not stand-off shelf angles, screws, bolts, or brick ties); mechanical openings (e.g., PTACs, PTHPs, through-wall air conditioners). It shall be apparent to the Rater that the exempted areas are intentionally designed details, or the exempted area shall be documented in a plan provided by the builder, architect, or engineer. The Rater need not evaluate the necessity of the designed detail to certify the building.

29. If used, insulated siding shall be attached directly over a water-resistive barrier and sheathing. In addition, it shall provide the required R-value as demonstrated through either testing in accordance with ASTM C 1363 or by attaining the required R-value at its minimum thickness. Insulated sheathing rated for water protection can be used as a water resistant barrier if all seams are taped and sealed. If non-insulated structural sheathing is used at corners, the advanced framing details listed in Item 3.7.3 shall be met for those wall sections.

30. In a building undergoing a gut rehabilitation, continuous interior insulation may be used in lieu of continuous exterior rigid insulation or insulated siding. This alternative does not require continuous interior insulation where a floor intersects an exterior wall, it only requires it from floor to ceiling. Continuous interior insulation is required where the demising wall intersects the exterior wall; however, it may be exempted per Footnote 28.

31. Double-wall framing is defined as any framing method that ensures a continuous layer of insulation covering the studs to at least the R-value required in Item 3.7.1 of the Checklist, such as offset double-stud walls, aligned double-stud walls with continuous insulation between the adjacent stud faces, or single-stud walls with 2x2 or 2x3 cross-framing. In all cases, insulation shall fill the entire wall cavity from the interior to exterior sheathing except at windows, doors and other penetrations.

32. Rim / band joists are exempt from this requirement. For the purpose of this requirement, "≤ 3 stories" refers to any portion of the building elevation where the wood-framed walls do not exceed 3 stories in height. Partial floors that meet the definition of a mezzanine or loft, as defined by the 2012 IRC, do not count as a story. All 'advanced framing' details shall be met except where the builder, architect, or engineer provides a framing plan that encompasses the details in question, indicating that structural members are required at these locations and including the rationale for these members (e.g., full-depth solid framing is required at wall corners or interior / exterior wall intersections for shear strength, a full-depth solid header is required above a window to transfer load to jacks studs, or additional jack studs are required to support transferred loads). The Rater shall retain a copy of the detail and rationale for their records, but need not evaluate the rationale to certify the building.

33. All exterior corners shall be constructed to allow access for the installation of ≥ R-6 insulation that extends to the exterior wall sheathing. Examples of compliance options include standard-density insulation with alternative framing techniques, such as using three studs per corner, or high-density insulation (e.g., spray foam) with standard framing techniques.

34. Compliance options include continuous rigid insulation sheathing, SIP headers, other prefabricated insulated headers, single-member or two-member headers with insulation either in between or on one side, or an equivalent assembly. R-value requirement refers to manufacturer's nominal insulation value.

35. Insulation shall run behind interior / exterior wall intersections using ladder blocking, full length 2x6 or 1x6 furring behind the first partition stud, drywall clips, or other equivalent alternative.

36. In Climate Zones 1 through 3, a continuous stucco cladding system sealed to windows and doors is permitted to be used in lieu of sealing rough openings with caulk or foam. [10]

37. For dwelling or sleeping units adjacent to garages, EPA recommends, but does not require, carbon monoxide (CO) alarms installed in a central location in the immediate vicinity of each separate sleeping zone and according to NFPA 720.

38. Where a sampling protocol is permitted in accordance with the National or California Program Requirements, at least 20% of the dwelling or sleeping units adjacent to a garage shall be selected for testing.

39. A 'ducted return' is defined as a continuous duct made of sheet metal, duct board, or flexible duct that connects one or more return grilles to the return-side inlet of the air handler. Any other approach to convey air from return or transfer grille(s) to the air handler, such as the use of building cavities, does not constitute a 'ducted return'. Where there are no 'ducted returns', the duct leakage test shall include the leakage from the air handler and supply side of the forced air system. Where building cavities used to return air to the air handler are included in the duct leakage test, the allowances for "One or two ducted returns" shall be permitted.
40. This section of the Checklist is designed to meet ASHRAE 62.1-2010 or later, ASHRAE 62.2-2010 or later, and ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new multifamily buildings when compared to multifamily buildings built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems, (e.g., those caused by a lack of maintenance or by occupant behavior). Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.
41. To be eligible for Track A – HVAC Grading by Rater, dwelling units must have at least one unitary HVAC system including air conditioners or heat pumps up to 65 kBtuh, or furnaces up to 125 kBtuh (i.e., within the scope of ANSI / RESNET / ACCA Standard 310). Track A – HVAC Grading by Rater shall use ANSI / RESNET / ACCA 310 including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the schedule defined by the HCO or MRO that the building is being certified under for all dwelling units.
42. For Track A, all unitary HVAC Systems including air conditioners and heat pumps up to 65 kBtuh and furnaces up to 125 kBtuh serving individual dwelling units shall comply with 5a.1 through 5a.4 for the building to be certified. Common spaces with those systems may choose to use ANSI / RESNET / ACCA 310 and complete Items 5a.1 through 5a.3, or to complete Item 5a.4 and Sections 2 and 3 on the National HVAC Functional Testing Checklist.

    For Track B, Item 5b.1 is applicable for all systems. Item 5b.2 is applicable to split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtuh with forced-air distribution systems (i.e., ducts). All systems shall comply with 5b.1 and 5b.2, as applicable, for the building to be certified.

    If, based on the selected Track, an Item in Section 5 is not applicable to any systems in the building, the Rater shall mark 'N/A' for that Item.
43. If the non-invasive procedure in ANSI / RESNET / ACCA 310 is not permitted to be used during the final inspection of a unit (i.e., due to the equipment type or to outdoor air temperatures that do not meet the requirements of the non-invasive method), then the unit is permitted to be certified with a default refrigerant charge designation of Grade III. Note that in these circumstances, the weigh-in method procedure in ANSI / RESNET / ACCA 310 may still be used to pursue a Grade I designation.
44. While this verification is completed as part of ANSI / RESNET / ACCA 310, it must also be documented in this checklist.
45. If installed equipment does not match the National HVAC Design Report, then prior to certification the Rater shall obtain written approval from the designer (e.g., email, updated National HVAC Design Report) confirming that the installed equipment meets the requirements of the National HVAC Design Report. In addition, the Rater shall verify that all installed equipment are still exempted types per Footnote 29 of the National HVAC Design Report or, if no longer an exempted type, shall re-review Section 4b of the National Rater Design Review Checklist to ensure compliance with all requirements (e.g., full completion of HVAC Design Report, HVAC design tolerances). In cases where the condenser unit is installed after the time of inspection by the Rater, the HVAC manufacturer and model numbers on installed equipment can be documented through the use of photographs provided by the HVAC Contractor or Functional Testing Agent after installation is complete.
46. The Rater shall measure and record the external static pressure in the return-side and supply-side of the system using the contractor-provided test locations. However, at this time, the Rater need not assess whether these values are within a specific range to certify the dwelling unit. Ductless systems and systems with a total amount of supply ductwork or distribution building cavities ≤ 10 ft. in length are exempted from this requirement. The Rater is also not required to measure external static pressure for multi-split systems and may mark "N/A".
47. Electric resistance limitations do not apply to heat pumps with integral supplemental or emergency electric resistance heating. EPA recommends but does not require that heat pumps have controls to limit the use of emergency or supplemental heat to heat pump failures or when the heat pump cannot meet the heating load. EPA also recommends but does not require that heat pumps in CZ 5-8 are ENERGY STAR certified cold-climate heat pumps. Electric resistance limitations do not apply to systems dedicated to heating outdoor air supplied by a mechanical ventilation system, as long as the space served is primarily heated by a non-electric-resistance system that meets the efficiency requirements noted in Exhibit X. Electric resistance limitations apply to garages, but do not apply to heated plenums meeting Item 5.11, or stairwells where automatic thermostatic controls prevent operation above 50°F.
48. Functional Testing Agents must hold an approved credential, as listed at www.energystar.gov/ftas, or must be a representative of the Original Equipment Manufacturer (OEM), or a contractor credentialed by an HVAC Quality Installation Training and Oversight Organization (H-QUITO), if not completing Sections 6 and higher. Functional Testing Agents may not be the installing contractor, nor employed by the same company as the installing contractor, unless they are a credentialed contractor. An explanation of the credentialing process and links to H-QUITOs, which maintain lists of credentialed contractors, can be found at www.energystar.gov/findhvac. A directory of other FT Agents can be found at www.energystar.gov/ftas. Raters can confirm FT Agents have met the requirements by documenting they are listed in a directory. For Track A Sections 2 and 3 of the National HVAC Functional Testing Checklist do not need to be completed for systems using ANSI / ACCA / RESNET 310 and meeting Items 5a.1 – 5a.3.
49. At the discretion of the Rater, a Licensed Professional (LP), (i.e., a Registered Architect or Professional Engineer in good standing and with a current license), may verify any of the items in Sections 5, 11, and 12 of this Checklist, where a checkbox is provided for "LP Verified". When exercised, the LP's responsibility will be formally acknowledged by the LP signing off on the checklist for the item(s) that they verified. However, if a quality assurance review indicates that Items have not been successfully completed, the Rater will be responsible for facilitating corrective action.
50. Kinks are to be avoided and are caused when ducts are bent across sharp corners such as framing members. Sharp bends are to be avoided and occur when the radius of the turn in the duct is less than one duct diameter. Compression is to be avoided and occurs when flexible ducts in unconditioned space are installed in cavities smaller than the outer duct diameter and ducts in conditioned space are installed in cavities smaller than inner duct diameter. Ducts shall not include coils or loops except to the extent needed for acoustical control.
51. Item 6.2 does not apply to ventilation ducts, exhaust ducts, or non-ducted systems. For an HVAC system with a multi-speed fan, the highest design fan speed shall be used when verifying this requirement. When verifying this requirement, doors separating bedrooms from the main

body of the dwelling unit (e.g., a door between a bedroom and a hallway) shall be closed and doors to rooms that can only be entered from the bedroom (e.g., a closet, a bathroom) shall be open. The Rater-measured pressure shall be rounded to the nearest whole number to assess compliance.

52. Item 6.3 does not apply to ducts that are a part of local mechanical exhaust or exhaust-only dwelling-unit mechanical ventilation systems. EPA recommends, but does not require, that all metal ductwork not encompassed by Section 6 (e.g., exhaust ducts, duct boots, ducts in conditioned space) also be insulated and that insulation be sealed to duct boots to prevent condensation.
53. Items 6.4 and 6.5 generally apply to the ducts of space heating, space cooling, and dwelling-unit mechanical ventilation systems.

    However, visual inspection is permitted in lieu of testing for the following system types: 1) a dwelling-unit mechanical ventilation system not connected to the space heating or space cooling system, regardless of the number of dwelling units it serves; 2) a space heating or space cooling system for which the ducts and air handler are in conditioned space and the total supply duct length of the system, including all supply trunks and branches, is ≤ 10 ft; and 3) a space heating or space cooling system that serves more than one dwelling unit. In such cases, a Rater shall visually verify that all seams and connections are sealed with mastic or metal tape and all duct boots are sealed to floor, wall, or ceiling using caulk, foam, or mastic tape.

    For duct systems requiring testing, duct leakage shall be determined and documented by a Rater using ANSI / RESNET / ICC 380 including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the schedule defined by the HCO or MRO that the building is being certified under. Leakage limits shall be assessed on a per-system, rather than per-dwelling unit, basis.
54. Note that compliance with Item 6.4.1 or 6.4.2 in conjunction with Section 4a of the National Rater Design Review Checklist automatically achieves Grade I total duct leakage per ANSI / RESNET / ACCA 310.
55. Cabinets (e.g., kitchen, bath, multimedia) or ducts that connect duct boots to toe-kick registers are not required to be in place during the 'rough-in' test.
56. Registers atop carpets are permitted to be removed and the face of the duct boot temporarily sealed during testing. In such cases, the Rater shall visually verify that the boot has been durably sealed to the subfloor (e.g., using duct mastic or caulk) to prevent leakage during normal operation.
57. Testing of duct leakage to the outdoors can be waived in accordance with the 2nd or 3rd alternative of ANSI / RESNET / ICC 301, Table 4.2.2 (1), footnote (w). Alternatively, testing of duct leakage to outdoors can be waived in accordance with Section 5.5.2 of ANSI / RESNET / ICC 380 if total duct leakage, at rough-in or final, is ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area or 40 CFM25, whichever is larger. Guidance to assist partners with these alternatives, including modeling inputs, is available at www.energystar.gov/newhomesguidance.
58. For the purpose of computing leakage allowance, at rough-in, the 'exhaust fan flow' shall be the lesser of the rated fan flow (i.e., nameplate rating) and 133% of the sum of the design exhaust airflow of the dwelling units served by that fan. At final, the 'exhaust fan flow' shall be the lesser of the rated fan flow (i.e., nameplate rating) and 143% of the sum of the design exhaust airflow of the dwelling units served by that fan. To calculate central exhaust duct leakage allowance, EPA recommends using worksheet 3b of the Multifamily Workbook. Measured fan flow (either at the fan itself or the total airflow measured from all exhaust grilles served by the fan) may be used in lieu of the rated fan flow to determine the leakage allowance. Duct leakage shall be tested at the design or average operating pressure and shall use the procedures in the *RESNET Guidelines for Multifamily Energy Ratings*, available at www.resnet.us/blog/resnet-adopts-guidelines-for-multifamily-energy-ratings/. Where testing at the design or average operating pressure is not feasible, testing at 50 Pa is permitted, however the following flow equation must be used to determine the leakage allowance at 50 Pa.

    $$CFM_{50} = CFM_{design} / [P_{design}^{(0.65)} / 50^{(0.65)}]$$

    No less than 50% of the ductwork, based on total linear feet, shall be tested and must include ductwork other than the main trunks. Where portions of ductwork are tested, rather than entire risers, the percentage of leakage allowed is based upon the design airflow of the dwelling units that are exhausted in that portion. Where failures occur, the percentage of total linear feet required to be tested increases by 10%.

    Where aerosol-based sealant is used on 100% of the exhaust ductwork between the fan and the grilles, the duct-sealing contractor is permitted to perform the test, but sampling is not permitted. Where tested at 25 Pa, the leakage allowance is permitted to be reduced according to the equation above by substituting "25" for "50". The Rater is not required to witness these tests. Where aerosol-based sealant is used on some but not all ductwork, the ductwork selected for testing must be representative of all sealing strategies used. This test is not required of central exhaust systems serving clothes dryers but is required for the central exhaust portion of balanced systems such as HRVs and ERVs.
59. As defined by ANSI / RESNET / ICC 301-2019, a Dwelling Unit Mechanical Ventilation System is a ventilation system consisting of powered ventilation equipment such as motor-driven fans and blowers and related mechanical components such as ducts, inlets, dampers, filters and associated control devices that provides dwelling-unit ventilation at a known or measured airflow rate.
60. Item 7.5 applies to any outdoor air inlet connected to a ducted return of the dwelling unit HVAC system, regardless of its intended purpose (e.g., for ventilation air, make-up air, combustion air). This Item does not apply to HVAC systems without a ducted return.
61. The dwelling-unit ventilation air flows and local exhaust air flows shall be determined and documented by a Rater using ANSI / RESNET / ICC 380 including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the schedule defined by the HCO or MRO that the building is being certified under. In Item 7.2, the dwelling-unit ventilation rates required by ASHRAE 62.2-2010 can be calculated using the Multifamily Workbook or the following equation: 0.01 x Conditioned Floor Area + 7.5 x (number of bedrooms + 1). For sleeping units, the following equation must be used: 0.01 x Conditioned Floor Area + 7.5 x (number of beds). Where local codes do not permit dwelling-unit ventilation to exceed ASHRAE 62.2-2010 rates, Rater-measured ventilation rate is permitted to be 0-15 CFM less than rates required by ASHRAE 62.2-2010. Designers are permitted to provide multiple combinations of a design ventilation airflow rate, run-time per cycle, and cycle time. When multiple combinations are provided, the Rater shall first assess the run-time setting of the installed system and use that to determine the corresponding design ventilation rate. The Rater-measured ventilation rate must fall within the program-specified tolerance relative to that design ventilation rate.
62. While common spaces are not under the scope of ANSI / RESNET / ICC 380, the ventilation air flow and exhaust air flows in common spaces shall be measured in accordance with the procedures in ANSI / RESNET / ICC 380. The air flows may be measured by a Rater or a certified air-balancing contractor under the observation of a Rater. Sampling is only permitted where airflows are measured directly by the Rater. Where a system provides supply air that is a mix of return and outdoor air, and not 100% outdoor air, the outdoor air airflow shall be measured

and compared to the total supply airflow to determine percentage of outdoor air supplied. This percentage shall be applied to airflow measured at supply registers to determine outdoor air provided for comparison to design airflow rates. Where the building has total corridor space ≤ 250 ft^2 and does not contain any of the other common spaces which require outdoor air per Item 2.2 of the National HVAC Design Report, outdoor air is not required to be provided to the corridor.

63. For permits on or before 01/01/2024, where outdoor air is supplied via a PTAC or PTHP, in lieu of measurement, the design CFM shall meet or exceed the ventilation rates required by ASHRAE 62.1-2010 and the space served by the PTAC or PTHP shall have at least one operable window. For permits after 01/01/2024, both the runtime and measurement of outdoor air through these systems will be required to demonstrate compliance with ASHRAE 62.1-2010 or alternative ventilation system specified (e.g., ducted supply).
64. For example, if an outdoor air inlet connected to a ducted return is used as a dedicated source of outdoor air for an exhaust ventilation system (e.g., bath fan), the outdoor airflow must be automatically restricted when the exhaust fan is not running and in the event of an override of the exhaust ventilation system.

    In dwelling / sleeping units in multifamily buildings, but not townhouses, automatic restriction of airflow is exempted if a manual shutoff damper is used with a continuous exhaust ventilation system and is readily-accessible, labeled as the override, and not used as a balancing damper.
65. When assessing the ventilation rate, the highest HVAC fan speed applicable to ventilation mode shall be used (e.g., if the inlet only opens when the HVAC is in 'fan-only' mode, then test in this mode). If the inlet has a motorized damper that only opens when the local mechanical kitchen exhaust is turned on, then testing is not required.

    When required, the ventilation airflow through the inlet shall be measured and documented by a Rater using ANSI / RESNET / ICC 380 including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the schedule defined by the HCO or MRO that the building is being certified under. As an alternative, measurement of the outdoor airflow can be waived if a Constant Airflow Regulating (CAR) damper with a manufacturer-specified maximum flow rate no higher than 15 CFM or 15% above the ventilation design value is installed on the inlet.
66. Dwelling-unit mechanical ventilation fans shall be rated for sound at no less than the airflow rate in Item 2.7 of the National HVAC Design Report. Fans exempted from this requirement include HVAC air handler fans, remote-mounted fans, and intermittent fans rated ≥ 400 CFM. To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways and there shall be ≥ 4 ft. ductwork between the fan and intake grille. Per ASHRAE 62.2-2010, habitable spaces are intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.
67. Note that the 'fan-on' setting of a thermostat would not be an acceptable controller because it would continuously operate the HVAC fan.
68. Bathroom fans with a rated flow rate ≥ 500 CFM and heat/energy recovery ventilation fans are exempted from the requirement to be ENERGY STAR certified.
69. As an alternative to meeting or exceeding the efficiency standards for NEMA Premium motors, documentation that an exhaust fan motor has a fan energy index (FEI) ≥ 1.2 at the design point of operation OR a fan efficacy ≥ 1.1 CFM/Watt is permitted.
70. Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the building owner or maintenance staff. Ventilation air inlets that are only visible via rooftop access are exempted from Item 7.10 and the Rater shall mark "N/A".
71. Two alternatives to the required 10 ft. distance are provided: 1) inlets providing outdoor air to a dwelling unit are permitted to be ≥ 5 ft. of stretched-string distance from outlets of both exhaust dwelling-unit mechanical ventilation systems and local mechanical exhaust systems, and 2) the outlet and inlet of ERV's and HRV's may use a smaller distance if allowed by the manufacturer of the system. If the second alternative is used, the manufacturer's instructions shall be collected for documentation purposes.
72. Known contamination sources include, but are not limited to, stacks, vents, exhausts, and vehicles.
73. Continuous bathroom local mechanical exhaust fans shall be rated for sound at no less than the airflow rate in Item 8.2. Intermittent bathroom and both intermittent and continuous kitchen local mechanical exhaust fans are recommended, but not required, to be rated for sound at no less than the airflow rate in Items 8.1 and 8.2. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope (e.g., bath exhaust fans, range hoods, clothes dryers). Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.
74. An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.
75. Where 5 ACH is selected, kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries, islands, peninsulas, ranges / ovens, and the kitchen exhaust fan, and multiplying by the average ceiling height for this area. In addition, the continuous kitchen exhaust rate shall be ≥ 25 CFM, per 2009 IRC Table M1507.3, regardless of the rate calculated using the kitchen volume. Cabinet volume shall be included in the kitchen volume. As an alternative to 5 ACH for Dwelling Units and Sleeping Units (but not Townhouses), 50 CFM of continuous exhaust is permitted to be used, regardless of kitchen volume. In such cases, the edge of the exhaust fan or intake grille shall be located within 10 ft of the edge of the range, as measured horizontally on the floor plan.
76. Alternatively, the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 or later are permitted to be used for kitchen exhaust fans based upon the rated airflow of the fan at 0.25 IWC. If the rated airflow is unknown, ≥ 6 in. smooth duct shall be used, with a rectangular to round duct transition as needed. Guidance to assist partners with these alternatives is available at www.energystar.gov/newhomesguidance. As an alternative to Item 8.1, dwelling units are permitted to use a continuous kitchen exhaust rate of 25 CFM per 2009 IRC Table M1507.3, if they are either a) Phius or PHI certified, or b) provide both dwelling-unit ventilation and local mechanical kitchen exhaust using a balanced system, and have a Rater-verified whole-building infiltration rate ≤ 1.0 ACH50 or ≤ 0.05 CFM50 per sq. ft. of Enclosure Area. 'Enclosure Area' is defined as the area of the surfaces that bound the volume being pressurized / depressurized during the test.

77. All intermittent kitchen exhaust fans must be capable of exhausting at least 100 CFM. In addition, if the fan is not part of a vented range hood or appliance-range hood combination (i.e., if the fan is not integrated with the range), then it must also be capable of exhausting ≥ 5 ACH, based on the kitchen volume.
78. Based upon, ASHRAE 62.2-2010, ducted mechanical systems are those that supply air to an occupiable space with a total amount of supply ductwork exceeding 10 ft. in length and through a thermal conditioning component, except for evaporative coolers. Systems that do not meet this definition are exempt from this requirement. While filters are recommended for mini-split systems, HRV's, and ERV's, these systems, ducted or not, typically do not have MERV-rated filters available for use and are, therefore, also exempted under this version of the requirements. HVAC filters located in the attic shall be considered accessible to the occupant, building owner, or building maintenance staff if either 1) drop-down stairs, a pull-down ladder, or door provide access to attic and a permanently installed walkway has been provided between the attic access location and the filter or 2) the filter location enables arm-length access from a portable ladder without the need to step into the attic and the height of the ceiling access panel or the bottom of the wall access panel where access is provided is ≤ 12 ft.
79. Sealing mechanisms comparable to a gasket are also permitted to be used. The filter media box (i.e., the component in the HVAC system that houses the filter) may be either site-fabricated by the installer or pre-fabricated by the manufacturer to meet this requirement. These requirements only apply when the filter is installed in a filter media box located in the HVAC system, not when the filter is installed flush with the return grille.
80. The pressure boundary is the primary enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to outside than to conditioned space would be outside the pressure boundary.
81. Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere; a mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure; and a natural draft system is a venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.
82. Naturally drafted equipment is only allowed if located in a space outside the pressure boundary, where the envelope assemblies separating it from conditioned space are insulated and air-sealed.
83. Where water heater efficiency is rated in Uniform Energy Factor (UEF) rather than Energy Factor (EF), the EF may be calculated from the Uniform Energy Factor (UEF) using the RESNET EF Calculator 2017. The calculated EF must meet the efficiency levels specified in the ENERGY STAR Multifamily Reference Design. Alternatively, electric water heaters serving dwelling units in buildings following National Version 1 or National Version 1.1, or serving common spaces following any Version, are permitted to be rated at 0.92 UEF instead of 0.93 UEF if the water heater rated storage volume is ≤ 50 gallons and the water heater height is ≤ 40 inches.
84. For common spaces where automatic lighting controls are not installed due to safety concerns associated with automatic lighting shutoff, the architect or engineer must provide the specific location(s) where this concern is applicable. The Rater shall retain a copy of the email or letter that documents the location(s) for their records and check the box in the "Rater Verified" column. For Item 12.1.1, this exemption does not apply to corridors or stairwells; where safety is a concern in those spaces, the ASHRAE Path should be pursued.
85. As an alternative to the efficiency requirements in Item 12.3, installed lighting may instead meet the following lighting power allowances. In common spaces (except garages), for ERI and Prescriptive Path, total installed lighting power for the combined common spaces ^{2} must not exceed ASHRAE 90.1-2007 allowances for those combined spaces, using the Space-by-Space or Building Area Method. For ASHRAE Path, total installed lighting power for the combined common spaces ^{2} must not exceed ASHRAE 90.1-2007 allowances for those combined spaces, using the Space-by-Space or Building Area Method, by more than 20%. In addition, for ASHRAE Path, where the proposed lighting power in a given space is modeled with 30% or greater savings compared to the allowance in the Simulation Guidelines, field measurement of footcandles is required. For all Paths, see Footnote 86 and 87 for allowances.
In shared garages, installed lighting shall not exceed 0.24 W/ft^2.
86. Senior housing buildings can use the space-by-space allowances for 'facilities for the visually impaired' in ASHRAE 90.1-2016 Appendix G Table G3.7 for spaces used primarily by building residents. For example, 1.15 W/SF lighting power allowance may be used for the corridors in the baseline. To qualify for the increased allowance, the building must be designed to comply with the light levels in ANSI / IES RP-28 and must provide housing for seniors and/or people with special visual needs. Prescriptive Path dwelling unit overall in-unit lighting power density is permitted to be ≤ 1.3 W/SF, using 1.65 W/SF where lighting is not installed.
87. Lighting power density values from ASHRAE 90.1-2007 Section 9 for Space-by-Space Method for typical common spaces in multifamily properties are shown in the table below. Buildings following the Building Area method, the lighting power density is 0.7 W/ft^2. For spaces not shown, refer to ASHRAE 90.1-2007 Section 9.

ASHRAE Space Type	Lighting Power Densities (W/ft^2)	ASHRAE Space Type	Lighting Power Densities (W/ft^2)	ASHRAE Space Type	Lighting Power Densities (W/ft^2)
Lobby / Elevator	1.3	Corridor / Transition	0.5	Office	1.1
Active Storage (e.g., trash chute / room, janitor closet)	0.8	Stairs – Active	0.6	Lounge / Recreation / Community Room / Computer Room	1.2
Inactive Storage (e.g., tenant storage)	0.3	Restroom	0.9	Electrical / Mechanical	1.5
Exercise Area / Room	0.9	Laundry Room	1.3	Workshop	1.9

88. This requirement applies to exterior lighting fixtures that are attached to the building, but does not apply to landscape or parking lot lighting fixtures.

89. For Prescriptive Path dwelling units, ENERGY STAR certified fixtures or light bulbs are required; however, the Rater is only responsible for verifying that the installed lighting meets the Tier I or Tier II definition specified in ANSI / RESNET / ICC 301. For locations outside the dwelling unit, as an alternative to ENERGY STAR certified fixtures or light bulbs, integrated LED fixtures or fixtures containing LED or fluorescent lamps are permitted. Note that for all locations in Version 1.2, light fixtures must be integrated LED fixtures or contain LED lamps and not fluorescent.
90. Appliances include refrigerators, dishwashers, clothes washers, and clothes dryers. Where an appliance type is not eligible for ENERGY STAR certification, (e.g., commercial dryers) the appliance is exempt from this requirement. Where a bathroom faucet or aerator is not eligible for WaterSense certification, (e.g., public use lavatory faucets) the fixture is exempt from this requirement.
91. Building area shall be calculated according to Gross Floor Area as defined by ENERGY STAR Portfolio Manager, which specifies to measure from the outside surface of exterior walls and includes all areas inside the building and excludes parking areas. Refer to the ENERGY STAR Portfolio Manager Glossary for a complete definition. Strategies include: an agreement with the utility companies to provide the aggregated building-level data, in a spreadsheet format or directly through Portfolio Manager; OR evidence that securing signed utility data release forms will be a mandatory component of all lease agreements; OR installation of a building-level energy monitor, data acquisition system, or utility-owned energy meter. If an energy monitor is installed, the builder shall provide the building operator with the manufacturer's documentation and operations manual. EPA recommends, but does not require, that one of these strategies also be implemented in buildings 25,000-49,999 ft^2.
92. Any Item that will be concealed by drywall (e.g., wall insulation) must be verified during the pre-drywall inspection.

    If drywall is installed prior to the inspection, then it must be entirely removed to fully verify all Items. It is not sufficient to remove only portions of drywall to inspect a subset of areas. Furthermore, it is not acceptable to complete a Sampled Rating on a unit that has missed the pre-drywall inspection. Additional information is available in the Technical Bulletin: Pre-Drywall Inspection Is Always Required.
93. Some Items can typically only be verified at a later stage of construction than when the pre-drywall inspection occurs (e.g., bath fan airflow). Any Item that has not been verified during the pre-drywall inspection must be verified prior to or during the final inspection.

Exhibit X – Prescriptive Minimum Heating and Cooling Equipment Efficiencies based on Version the building is certified to. Version 1, Version 1.1, and Oregon and Washington Version 1.2: †

Equipment Type	Minimum Efficiency
Room AC (window, through-wall, ductless mini-splits)	ENERGY STAR certified
Air conditioners, air cooled (<13 Kbtu/h)	13 SEER
Air conditioners, air cooled (≥13 and <65 Kbtu/h)	See Reference Design
Air conditioners, air cooled (≥65 and <240 Kbtu/h)	11.5 EER/12.0 IEER
Air conditioners, air cooled (≥240 and < 760 Kbtu/h)	10.0 EER/10.5 IEER
Electric resistance space heating [47]	• Not permitted in any dwelling unit using the Prescriptive Path • Electric resistance heating specified in common spaces and garages have a total heating capacity ≤ 12 kBtu/h (3.5 kW) per enclosed space and has automatic thermostatic controls
Warm-Air Furnace (<225 KBtu/h, common spaces)	78% AFUE or 80% Et
Warm-Air Furnace (<225 KBtu/h, dwelling units)	See Reference Design. For PTAC, use 80% Et
Warm-Air Furnace (≥225 KBtu/h)	80% Et (gas) or 81% Et (oil)
Packaged Terminal Air Conditioner (PTAC < 7 kBtu/h)	11.9 EER
Packaged Terminal Air Conditioner (PTAC > 15 kBtu/h)	9.5 EER
Packaged Terminal Air Conditioner (≥7 and ≤15 KBtu/h)	14.0 – (0.300 X Cap/1000) EER
Packaged Terminal Heat Pump (PTHP)	Cooling: 14.0– (0.3 X Cap/1000) EER Heating: 3.7– (0.052 X Cap/1000) COP
Air cooled heat pump (≥13 and <65 KBtu/h)	See Reference Design
Air cooled heat pump (≥65 and <240 KBtu/h)	Cooling: 11.1 EER/11.6 IEER Heating: 3.3 COP (@47°F DB)
Air cooled heat pump (≥240 KBtu/h)	Cooling: 9.6 EER/9.6 IEER Heating: 3.2 COP (@47°F DB)
Water-source heat pump (<135 KBtu/h)	Cooling: 14.0 EER(86°F entering water) Heating: 4.2 COP(68°F entering water)
Boilers, hot water (<300,000 Btu/h)	See Reference Design
Boilers, hot water (≥300,000 Btu/h)	86% E_t (89% E_t if using heat pumps)
VRF Air Conditioners and Heat Pumps	See Tables 6.8.1I and 6.8.1J of ASHRAE 90.1-2010
Air-cooled chillers with or without condenser	10.0 EER / 12.5 IPLV
Water-cooled chiller, positive displacement (<75 tons)	0.780 kW/ton (Full load) / 0.630 kW/ton (IPLV)
Water-cooled chiller, positive displacement (75-150 tons)	0.775 kW/ton (Full load) / 0.615 kW/ton (IPLV)
Water-cooled chiller, positive displacement (150-300tons)	0.680 kW/ton (Full load) / 0.580 kW/ton (IPLV)
Water-cooled chiller, positive displacement (>300 tons)	0.620 kW/ton (Full load) / 0.540 kW/ton (IPLV)
Water-cooled, centrifugal (<300 tons)	0.634 kW/ton (Full load) / 0.596 kW/ton (IPLV)
Water-cooled, centrifugal (≥300 and <600 tons)	0.576 kW/ton (Full load) / 0.549 kW/ton (IPLV)
Water-cooled, centrifugal (≥600 tons)	0.570 kW/ton (Full load) / 0.539 kW/ton (IPLV)
Air-cooled absorption single effect chiller	0.6 COP
Water-cooled absorption single effect chiller	0.7 COP
Absorption double effect indirect-fired chiller	1.0 COP (Full load) / 1.05 COP (IPLV)
Absorption double effect direct-fired chiller	1.0 COP (Full load) / 1.00 COP (IPLV)
Open-loop propeller or axial fan cooling towers*	>40 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
Closed-loop propeller or axial fan cooling towers*	>15 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)
Open-loop centrifugal fan cooling towers*	>22 gpm/hp (@95°F entering water, 85°F leaving water, 75°F wb entering air)
Closed-loop centrifugal fan cooling towers*	>8 gpm/hp (@102°F entering water, 90°F leaving water, 75°F wb entering air)
Air source DX-DOAS (dehumidification mode)	4.0 ISMRE
Air source DX-DOAS (heat pump, heating mode)	2.7 ISCOP
Other DX-DOAS (e.g., water source)	See ASHRAE 90.1-2016; Table 6.8.1-15

Cap means the rated capacity of the product in Btu/h. If < 7,000 Btu/h, use 7,000; if > 15,000, use 15,000 in calculation.
† For Equipment Types not listed here, minimum efficiencies shall be based on those listed in ASHRAE 90.1-2010.
*Cooling tower fan motors must be equipped with VFD controlled by a temperature sensor on the condenser water supply pipe.

Version 1.2:

For Equipment Types not listed here, minimum efficiencies shall be based on 5% improvement over those listed in ASHRAE 90.1-2019. Use the efficiency values for "after 1/1/2023" where listed.

Equipment Type	CZ 1-4 [10]	CZ 4C-8 [10]
Room AC (window, through-wall)	ENERGY STAR certified	
Air conditioners, air cooled (Split system & single package)		
Air conditioners, air cooled (<65 kBtu/h)	See Reference Design	
Air conditioners, air cooled (≥65 and <135 kBtu/h)	15.7 IEER	14.6 IEER
Air conditioners, air cooled (≥135 and <240 kBtu/h)	15.1 IEER	14.0 IEER
Air conditioners, air cooled (≥240 and < 760 kBtu/h)	14.1 IEER	13.0 IEER
Electric resistance space heating [47]	• Not permitted in any dwelling unit using the Prescriptive Path • Electric resistance heating specified in common spaces has a total heating capacity ≤ 12 kBtu/h (3.5 kW) per enclosed space and has automatic thermostatic controls	
Warm-Air Furnace (<225 kBtu/h, common spaces)	See Reference Design	CZ 5-8 90% AFUE
Warm-Air Furnace (≥225 kBtu/h, common spaces)	80% Et	81% Et
Warm-Air Furnace (dwelling units)	See Reference Design	
Packaged Terminal Air Conditioner (PTAC), w/gas-fired heat (dwelling units)	80% Et	82% Et, AND 0.25 cfm50/ft2 avg per unit
PTAC (dwelling units)	12.5 EER	11.9 EER
PTAC (common spaces)	<7 kBtu/h: 12.5 EER	<7 kBtu/h: 11.9 EER
	≥7 and ≤15 kBtu/h: 14.7 - (0.320 X Cap/1000) EER	≥7 and ≤15 kBtu/h: 14.0 - (0.300 X Cap/1000) EER
	>15 kBtu/h: 10.0 EER	>15 kBtu/h: 9.5 EER
Packaged Terminal Heat Pump (PTHP) (cooling) †	<7 kBtu/h: 12.5 EER	<7 kBtu/h: 11.9 EER
PTHP (dwelling units, cooling) †	≥7 and ≤ 10 kBtu/h: 14.7 - (0.320 X Cap/1000) EER	≥7 and ≤ 15 kBtu/h: 14.0 - (0.300 X Cap/1000) EER
	> 10 kBtu/h: 11.5 EER	> 15 kBtu/h: 9.5 EER
PTHP (common spaces, cooling) †	≥7 and ≤ 15 kBtu/h: 14.7 - (0.320 X Cap/1000) EER	≥7 and ≤ 15 kBtu/h: 14.0 - (0.300 X Cap/1000) EER
	>15 kBtu/h: 10.0 EER	>15 kBtu/h: 9.5 EER
PTHP (dwelling units, heating) †	< 8 kBtu/h: 3.3 COP ≥ 8 kBtu: 3.7– (0.052 X Cap/1000)	3.4 COP
PTHP (common spaces, heating) †	<7 kBtu/h: 3.3 COP	<10.5 kBtu/h: 3.4 COP
	≥7 and ≤15 kBtu/h: 3.7– (0.052 X Cap/1000) COP	≥10.5 and ≤12 kBtu/h: 3.3 COP
	> 15 kBtu/h: 2.9 COP	> 12 kBtu/h: 3.2 COP
Air cooled heat pump (Split system and single package) †		
Air cooled heat pump (<65 kBtu/h)	See Reference Design	
Air cooled heat pump (≥65 and <135 kBtu/h)	15.1 IEER, 3.5 COP	
Air cooled heat pump (≥135 and <240 kBtu/h)	14.4 IEER, 3.4 COP	
VRF Air Conditioners and Heat Pumps†	16.2 IEER, 3.3 COP	
Water-loop heat pump (WLHP) (<135 kBtu/h) †	15.0 EER, 4.5 COP	
Boilers, hot water (<300,000 Btu/h, dwelling units)	See Reference Design	
Boilers, hot water (≥300,000 Btu/h, dwelling units)	CZ 1-3 80% Et CZ 4 86% Et (89% Et with WLHP)	95% Et (90% Et with WLHP)
Boilers, hot water (common Spaces)	CZ 1-3 80% AFUE or Et CZ 4 86% AFUE or Et	86% AFUE or Et

Cap means the rated capacity of the product in Btu/h.

† Where domestic hot water is provided by heat pump water heaters, the systems noted above with an † may instead meet the efficiency listed in ASHRAE 90.1-2019. Use the efficiency values for “after 1/1/2023” where listed.

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