

SECTION 00 0101
PROJECT TITLE PAGE

CINCINNATI METROPOLITAN HOUSING AUTHORITY

PROJECT NAME:

THE BEECHWOOD

300 Forest Avenue, Cincinnati, Ohio 45229

OWNER:

CINCINNATI METROPOLITAN HOUSING AUTHORITY

1627 Western Avenue, Cincinnati, Ohio 45214

ARCHITECT:

BERARDI + PARTNERS, Inc., ARCHITECTS, ENGINEERS

1398 Goodale Boulevard, Columbus, Ohio 43212

CIVIL ENGINEER:

GUIDER WINKLE PARTNERS

19550 Delaware County Line Road, Marysville, Ohio 43040

SYSTEMS ENGINEER:

PTA ENGINEERING

275 Springside Drive, Suite 300, Akron, Ohio 44333

STRUCTURAL ENGINEER:

DERWACTER & ASSOCIATES, LLC

5275 Milford Drive, Zanesville, Ohio 43701

LENDER:

TBD

BONDING AGENT:

TBD

FHA NUMBER:

2024-3004

DATES OF DOCUMENT:

Bid Set: 01/05/2024

SIGNATURES:

OWNER DATE

OWNER DATE

OWNER DATE

OWNER DATE

OWNER DATE

OWNER DATE

OWNER DATE

BERARDI+COLUMBUS

ARCHITECTURE | INTERIOR DESIGN | ENGINEERING



GEORGE D. BERARDI
LICENSE # 6480
EXPIRES: 12.31.2025

**SECTION 00 0102
PROJECT INFORMATION**

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Project Name: CMHA The Beachwood, located at 330 Forest Avenue, Cincinnati Ohio 45229.
- B. Berardi Project Number: 20178.
- C. The Owner, hereinafter referred to as Owner: Cincinnati Metropolitan Housing Authority.

1.02 NOTICE TO PROSPECTIVE BIDDERS

- A. These documents constitute an Invitation to Bid to and request for qualifications from General Contractors for the construction of the project described below.

1.03 PROJECT DESCRIPTION

- A. Summary Project Description:
 - 1. Beachwood Apartments is an existing 149-unit multi-family complex consisting of one, 13-story building that houses an assortment of studios, one, two-bedroom garden flats, and one-bedroom accessible garden flats units. Shared common amenities are located on the first floor. The proposed renovations will result in a total of 146 units, with 20% being accessible upon completion. The project is being developed under OHFA Limited Scope Rehabilitation Sustainability Standards and must meet all requirements. Accessibility will be in conformance with the Fair Housing Act guidelines, ICC/ANSI A117.1-2009, Ohio Building Code, and Americans with Disabilities Act Architectural Guidelines.
- B. Contract Scope: Construction, demolition, construction financing, and facility operations during occupancy.
- C. Contract Terms: Lump sum (fixed price, stipulated sum).

1.04 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- B. Time Restrictions:
 - 1. Limit conduct of especially noisy exterior work to the hours of 8:00 am. - 5:00 pm...
 - 2. Limit conduct of especially noisy interior work to the hours of 7:00 am. - 5:00 pm...
- C. Utility Outages and Shutdown:
 - 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 2. Limit shutdown of utility services to 3 hours at a time, arranged at least 48 hours in advance with Owner.
 - 3. Prevent accidental disruption of utility services to other facilities.

1.06 PROJECT CONSULTANTS

- A. Owner's LEED Consultant: SOL Design + Consulting.
- B. Owner's Third Party Special Inspections Consultant: tbd.

1.07 PROCUREMENT TIMETABLE

- A. Last Request for Substitution Due: 7 days prior to due date of bids.
- B. Last Request for Information Due: 7 days prior to due date of bids.
- C. Contract Time: To be stated in bid documents.
- D. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.08 PROCUREMENT DOCUMENTS

- A. Availability of Documents: Complete sets of procurement documents may be obtained:
 - 1. Documents may be downloaded from the Architect's File Transmission Protocol (FTP) site or Cloud. Contact the Architect for specific requirements for access.
 - 2. From Owner at the Project Manager's address listed above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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"General Decision Number: OH20230082 12/22/2023

Superseded General Decision Number: OH20220082

State: Ohio

Construction Type: Building

County: Hamilton County in Ohio.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	<ul style="list-style-type: none">. Executive Order 14026 generally applies to the contract.. The contractor must pay all covered workers at least \$16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	<ul style="list-style-type: none">. Executive Order 13658 generally applies to the contract.. The contractor must pay all covered workers at least \$12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/06/2023
1	01/13/2023
2	03/03/2023
3	04/14/2023
4	06/30/2023
5	07/14/2023
6	08/04/2023
7	11/17/2023
8	12/22/2023

ASBE0008-010 03/01/2023

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 33.08	20.69

BROH0018-008 06/01/2022

	Rates	Fringes
BRICKLAYER.....	\$ 31.87	16.39
TILE FINISHER.....	\$ 24.20	14.01
TILE SETTER.....	\$ 30.87	15.87

CARP0002-008 06/01/2023

	Rates	Fringes
CARPENTER (Accoustical Ceiling Installation Only).....	\$ 30.22	18.28

CARP0002-014 06/01/2023

Rates	Fringes
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CARPENTER (Including Drywall Hanging, Metal Stud Installation and Form Work; Excludes Acoustical Ceiling Installation).....\$ 30.22 18.28

 * ELEC0212-010 06/05/2023

	Rates	Fringes
ELECTRICIAN (Excludes Low Voltage Wiring).....	\$ 34.41	21.55

 ELEV0011-002 01/01/2023

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 52.72	37.335+a+b

PAID HOLIDAYS:

a. New Year's Day, Memorial Day, Independence Day, Labor Day, Vetern's Day, Thanksgiving Day, the Friday after Thanksgiving, and Christmas Day.

b. Employer contributes 8% of regular hourly rate to vacation pay credit for employee who has worked in business more than 5 years; 6% for less than 5 years' service.

 ENGI0018-036 05/01/2019

	Rates	Fringes
POWER EQUIPMENT OPERATOR Backhoe/Excavator/Trackhoe; Bulldozer; Crane.....	\$ 37.14	15.20

 ENGI0018-037 05/01/2018

	Rates	Fringes
POWER EQUIPMENT OPERATOR Bobcat/Skid Steer/Skid Loader.....	\$ 35.89	15.09

 ENGI0066-045 06/01/2017

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
Forklift.....	\$ 28.87	19.66
Grader/Blade.....	\$ 32.42	19.66
Mechanic.....	\$ 32.92	19.66

 IRON0044-003 06/01/2023

	Rates	Fringes
IRONWORKER, REINFORCING.....	\$ 32.87	23.30

 IRON0044-019 06/01/2023

	Rates	Fringes
IRONWORKER (Ornamental and Structural).....	\$ 32.37	23.30

 LAB00265-017 05/01/2021

	Rates	Fringes
LABORER		
Common or General.....	\$ 23.05	17.10

 LAB00265-019 05/01/2021

	Rates	Fringes
LABORER		
Mason Tender - Brick.....	\$ 23.05	17.10

 PAIN0123-001 05/01/2023

	Rates	Fringes
PAINTER (Brush and Roller).....	\$ 28.07	12.73

 PAIN0387-002 11/01/2022

	Rates	Fringes
GLAZIER.....	\$ 30.33	17.22

 PLAS0132-018 06/01/2023

Rates	Fringes
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CEMENT MASON/CONCRETE FINISHER...\$ 30.50 14.99

PLAS0132-019 07/01/2023

Rates Fringes

PLASTERER.....\$ 28.40 16.24

PLUM0392-005 06/01/2023

Rates Fringes

PIPEFITTER (Includes HVAC
Pipe Installation).....\$ 38.62 25.83

PLUMBER (Excludes HVAC Pipe
Installation).....\$ 38.62 25.83

* ROOF0042-007 08/01/2023

Rates Fringes

ROOFER.....\$ 32.00 19.00

SFOH0669-009 04/01/2023

Rates Fringes

SPRINKLER FITTER (Fire
Sprinklers).....\$ 43.08 26.91

SHEE0024-029 06/01/2023

Rates Fringes

SHEET METAL WORKER (Including
HVAC Duct Installation Only).....\$ 34.32 23.77

* UAVG-OH-0021 01/01/2019

Rates Fringes

OPERATOR: Oiler.....\$ 27.56 16.37

SUOH2012-084 08/29/2014

Rates Fringes

ELECTRICIAN (Low Voltage

Wiring Only).....	\$ 22.28	8.63
LABORER: Asphalt, Includes Raker, Shoveler, Spreader and Distributor.....	\$ 26.19	8.99
LABORER: Landscape & Irrigation.....	\$ 23.60	0.87
LABORER: Mason Tender - Cement/Concrete.....	\$ 23.87	9.80
LABORER: Pipelayer.....	\$ 23.18	8.95
OPERATOR: Loader.....	\$ 29.66	12.61
OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....	\$ 30.28	13.29
OPERATOR: Roller.....	\$ 29.85	12.00
PAINTER: Spray.....	\$ 22.78	12.40
TRUCK DRIVER: Dump (All Types)...	\$ 24.32	11.73

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave
for Federal Contractors applies to all contracts subject to the
Davis-Bacon Act for which the contract is awarded (and any
solicitation was issued) on or after January 1, 2017. If this
contract is covered by the EO, the contractor must provide
employees with 1 hour of paid sick leave for every 30 hours
they work, up to 56 hours of paid sick leave each year.
Employees must be permitted to use paid sick leave for their
own illness, injury or other health-related needs, including
preventive care; to assist a family member (or person who is
like family to the employee) who is ill, injured, or has other
health-related needs, including preventive care; or for reasons
resulting from, or to assist a family member (or person who is
like family to the employee) who is a victim of, domestic
violence, sexual assault, or stalking. Additional information
on contractor requirements and worker protections under the EO
is available at
<https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average

calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====

END OF GENERAL DECISION

"

BID FORM

SOLICITATION #: 2024-3004

RAD Conversion Renovations
At
330 FOREST AVE
CINCINNATI, OH 45229

TO THE CINCINNATI METROPOLITAN HOUSING AUTHORITY (CMHA)

Ladies and/or Gentlemen:

1. In submitting this bid, it is understood that the right is reserved by the Cincinnati Metropolitan Housing Authority to reject any and all bids. If written notice of the acceptance of this bid is mailed, telegraphed or delivered to the undersigned within **280** days after the opening thereof, or at any time thereafter before this bid 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".
2. Security in the sum of _____ Dollars (\$_____) in the form of _____ is submitted herewith in accordance with the Specifications.
3. Attached hereto is an affidavit in proof that the undersigned has not entered into any collusion with any person in respect to this bid or any other bid or the submitting of bids for the contract for which this bid is submitted. Also attached is a completed Form HUD-5369-A, Representations, Certifications, and Other Statements of Bidders.
4. Work under this Contract will begin immediately upon the successful Contractor's receipt of a "Notice to Proceed" from CMHA. "Notice to Proceed" will follow the completion of an executed contract.

5. **ADDENDA**

Bidder acknowledges receipt of the following Addenda:

ADDENDUM NO. _____ DATED _____
 ADDENDUM NO. _____ DATED _____
 ADDENDUM NO. _____ DATED _____

6. **BASIS OF CONTRACT AWARD**

CMHA intends to award this contract for **Solicitation No. 2024-3004** entitled "**RAD Conversion Renovations at 330 Forest Ave, Cincinnati OH 45229**", to the responsible bidder submitting the LOWEST "TOTAL BID" complying with these Public Bid Specifications, Drawings and Addenda, if any, provided the Contractor's, bid is reasonable and it is in the best interest of CMHA to accept it. The LOWEST "TOTAL BID" will be the bid reflecting the lowest dollar amount in the "TOTAL BID".

The undersigned having familiarized themselves with the local conditions affecting the cost of the work, and with the Drawings and Specifications, issued and Addenda, if any thereto, as prepared by the Development Division of the Cincinnati Metropolitan Housing Authority,

propose to furnish all labor, materials, equipment, permits and services required to complete the work identified herein at the prices listed below.

7. **CONTRACT TIME**

The contract performance period from the "Notice to Proceed" until substantial completion, will be 540 **calendar days** for the "Total Bid".

8. **BID AMOUNT - TOTAL**

The total Bid Amount all work indicated in the Specification, Drawings and Addendums **(excluding specialty equipment (i.e. cabinet casework, solid surface countertops, mirrors (expect for restroom mirrors, shelving units, hair dryer holders, salon chairs, salon shampoo chairs/bowls, vending machines, chairs & appliances).**

TOTAL BID SUM OF (WORDS)

_____ **DOLLARS.**

TOTAL BID SUM OF (FIGURES) \$ _____.

NOTE: The Total Bid Amount shall be shown in both words and figures; in case of discrepancy, the amount in words shall govern. To be valid bid, the bid form must be filled out in it's entirety with all certifications and affidavits. It must be submitted with and is part of the Bid Documents.

The penalty for making false statements in any offer is prescribed in 19 U.S.C. 1001.

Date: _____

Company: _____

Address: _____

By: _____

City, State, Zip _____

Title: _____

Fed. Tax ID: _____

(Signature of Bidder)

NOTE: LATE BIDS WILL NOT BE RECEIVED. THE LOBBY CLOCK ESTABLISHES THE TIME FOR THE BID OPENING.

**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)(1) 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)(1) 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.

[] [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 operations 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
- [] Asian Pacific Americans
- [] Hispanic Americans
- [] Asian Indian Americans
- [] Native 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 commercial, 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)

NON COLLUSIVE AFFIDAVIT

State of _____)

ss

County of _____)

_____, being first sworn, deposes:

and says that he is _____ of _____
(sole owner, partner, etc.) (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

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DISCLOSURE OF LOBBYING ACTIVITIES

**Certification 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.

Executed this _____ date of _____, 20_____.

By _____
(signature)

(type or print name)

(title, if any)

Covered Action: _____
(type and identify program, project or activity)

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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-permittee, 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 is 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 within 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 Contractor 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. 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 its 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 its 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 Contractor 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 except 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 for Contract 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 540 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.
- 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 Contractor 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 or 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;

- xii. Plumbing;
 - xiii. HVAC;
 - xiv. Roofing and/or sheet metal;
 - xv. Scaffolding;
 - xvi. Spray-on fireproofing;
 - xvii. Sprinkler and/or fire protection; or
 - xviii. 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 for each day of delay the amount listed in the table in 16.1.4.
 - 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.

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 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, 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 or 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, Training, and Contracting Opportunities for Low-Income Persons, the Contractor shall participate in CMHA's Section 3 Program.
- 18.2.** 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.
- 18.2.1.** 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.
- 18.3.** The parties to this Contract agree to comply with HUD's regulations in [24 CFR](#), 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](#), 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](#).
- 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](#).
- 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](#) require employment opportunities to be directed, were not filled to circumvent the Contractor's obligations under [24 CFR](#).
- 18.7.** Noncompliance with HUD's regulations in [24 CFR](#) 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 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 identifying information on all new hires and all subcontractors.
- 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, will 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 infringement.
- 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 within 540 calendar days of the date for commencement of the Work 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 Contractor 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 exemption 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 day 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 Time MODIFICATIONS, 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 Contractor 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 a 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.

WAGE DETERMINATION

- 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 Project falls under the residential construction type.
- C. The Wage Determinations provided shall be closely monitored by the contractor/bidder/quoter 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 wage liabilities.
- D. It shall be the Prime Contractor’s responsibility to verify the accuracy of the reported wages, including his subcontractors.
- E. It shall be the Prime Contractor’s responsibility to include the applicable Prevailing Wages and the Fair Labor Standards Provision in all contracts with Sub-Contractors on the project.
- F. 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.
- G. 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 any risk 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.
- H. The following pages are the Prevailing Rates of Wages as ascertained by the State or other Agency for this Project.
- I. Listed below is a checklist of items required for Wage and Hour Compliance.
- J. 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. 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
- Weekly certified payrolls that include:

<input type="checkbox"/> Contractor’s Name	<input type="checkbox"/> Calendar Days
<input type="checkbox"/> Contractor’s Address	<input type="checkbox"/> Hours Worked
<input type="checkbox"/> Payroll #	<input type="checkbox"/> Total Hours
<input type="checkbox"/> Week Ending Date	<input type="checkbox"/> Rate of Pay
<input type="checkbox"/> Project and Location	<input type="checkbox"/> Gross Amount Earned
<input type="checkbox"/> Contract or Purchase Order No.	<input type="checkbox"/> Taxes or Write 1099 across columns if employee files his own taxes
<input type="checkbox"/> Name of Employee	<input type="checkbox"/> Statement of Compliance (<i>back page of the payroll sheet</i>)
<input type="checkbox"/> Social Security Number/Address of Employee	<input type="checkbox"/> One of the boxes checked indicating if fringes benefits are paid in cash or approved program
<input type="checkbox"/> No. of Exemptions	<input type="checkbox"/> Contractor’s Signature certifying payroll
<input type="checkbox"/> Work Classification	

- General and Subcontractors form (*if applicable*)
- Employment Utilization Report (*upon completion*)
- Section 3 Form (*if applicable*)

Signature _____ Date _____

Note: Bids may not be accepted if this form is not acknowledged and signed.



**Minority Business Enterprise (MBE)
&
Women Business Enterprise (WBE)
Participation**

Contract/PO#: _____ Project Description: _____

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. Any questions regarding CMHA's MBE/WBE Program should be directed to Jacquetta Brown at 513-977-5683 or to Section3@cintimha.com.

Using Best Efforts to Achieve MBE/WBE Goals: 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 bids/quotes from selected MBE/WBE companies

Notification of MBE/WBE Participation: 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, Contractor agrees to submit proof of payment made to each MBE/WBE subcontractor listed on the MBE/WBE Participation Form (see attached).

Waiver of MBE/WBE Participation Goals: 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/proposer 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.

Company Name _____

Contact Person _____

Signature _____ Date _____

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Contractor's MBE/WBE Participation Report Form

Contract/PO#: _____ Project Description: _____

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

Name of Subcontractor(s)	MBE	WBE	\$ Dollar Amount	% of Contract Amount
Total <u>MBE</u> Dollar Amount and Percentage of Contract Amount				
Total <u>WBE</u> Dollar Amount and Percentage of Contract Amount				

Company Name _____

Contact Person (print) _____

Signature _____

Date _____

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Prospective Business Vendor:

Enclosed, you will find a variety of forms regarding Section 3 (Housing & Urban Development Opportunities Act of 1968, as amended). Please complete and attach the Section 3 forms with your bid submission. **Failure to submit the appropriate forms may jeopardize the proposal/bid up to and including the possibility of said proposal/bid being deemed non-responsive**

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, quote or proposal is submitted to CMHA.

Section 3 Required Forms:

- 1) Section 3 Assurance of Compliance & Section 3 Clause
- 2) Section 3 Action Plan
- 3) Section 3 Certification for Preference
- 4) Preference Category Acknowledgement S3 Residents

If you need any assistance or help regarding Section 3, feel free to contact us. We look forward to assisting you with Section 3 implementation.

Sincerely,

Jacquetta Brown

Jacquetta Brown
Economic Inclusion Coordinator
(513) 977-5683

Jacquetta.Brown@cintimha.com
Section3@cintimha.com



Contractor Section 3 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 the Section 3 Action Plan information attached. **All Sections need to be completed and signed.** 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:

Name(s): _____

Contact Info: _____

Title(s): _____

Section 3 Hiring/Training Opportunity Strategies

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 Residents when new hiring/training opportunities are generated through the awarding of the contract. **Some of the items will be mandatory as indicated with **.** Your acknowledgement is still needed, so please check accordingly.

The Section 3 Action Plan is subject to audit at anytime during the awarding of the contract through the duration of the contract by the Section 3 Compliance Coordinator.

**** Commit that when new workers are hired by the company and/or subcontractors as a result of the contract, 30% of those hired will be Section 3 Residents.**

**** Contact the CMHA Section 3 Compliance Coordinator regarding new hiring and training opportunities.**

**** Provide the CMHA Section 3 Compliance Coordinator with a monthly report listing all hiring and training opportunities.**

**** Post notice (placards) at the worksite where the work is being done, indicating any new hiring and training opportunities**

Facilitate or co-facilitate Hiring Halls within close proximity to where the work is being done for Section 3 Residents.

Contact/Meet with Resident Associations informing them of new training and hiring opportunities.

Advertise new training and hiring 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 Residents 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 Residents 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 Residents to be trained and/or employed during the contract.

Other:

Note: You are required to 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.

Signature: _____

Date: _____

Section 3 Subcontracting Opportunity Strategies

Please check any and all efforts from the below mentioned categories that your company will utilize to recruit, solicit, encourage, facilitate and contract with Section 3 Business Concerns when new subcontracting opportunities are generated through the awarding of the contract. **Some of the items will be mandatory as indicated with **.** Your acknowledgement is still needed, so please check accordingly.

The Section 3 Action Plan is subject to audit at anytime during the awarding of the contract through the duration of the contract by the Section 3 Compliance Coordinator.

**** Commit that when subcontracting occurs, 10% of the total dollar amount subcontracted out by the company and/or by subcontractors will go to Section 3 Business Concerns.**

**** Contact the CMHA Section 3 Compliance Coordinator regarding all new subcontracting opportunities.**

**** 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 Concerns.

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:

Note: You are required to 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.

Signature: _____

Date: _____



CMHA
Section 3 Assurance of Compliance Form

Training, Employment, and Contracting Opportunities for Section 3 Residents and Section 3 Business Concerns

- A. 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 Residents (30% minimum goal of new hires) upon their qualifications.
 - Section 3 Business Concerns (10% of total construction subcontracting dollar amount awarded – based upon their qualifications).
 - Section 3 Business Concerns (3% of total non-construction subcontracting dollar amount awarded- based upon their qualifications).
- B. 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 135, 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 135.20 (b) 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.
- C. Compliance with the provision of Section 3, the regulations set forth in 24 CFR Part 135, 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 135.

Applicant: _____

Signature: _____

Address: _____

Date: _____

Section 3 Clause

All Section 3 covered contracts shall include the following clause (referred to as the "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 135, 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 135 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 135, 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 135. 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 135.
- 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 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 135.
- F. Noncompliance with HUD's regulations in 24 CFR part 135 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.

CONTRACT BOND
(O.R.C. § 153.57)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned ("Contractor"), as principal, and _____, as surety, are hereby held and firmly bound unto the Cincinnati Metropolitan Housing Authority (CMHA) ("Owner") as obligee, in the penal sum of _____ Dollars (\$ _____), for the payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH that whereas, the above-named principal did on the _____ day of _____, 20____, enter into a contract with the Owner for _____ related to The Beechwood Apartments ("Project"), which said contract is made a part of this bond the same as though set forth herein:

Now, if the said Contractor shall well and faithfully do and perform the things agreed by the Contractor to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, materialmen, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions in or to the terms of the said contract or in or to the plans or specifications therefore shall in any wise affect the obligations of said surety on its bond, and does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications.

Signed and sealed this _____ day of _____, 20____.

(PRINCIPAL)

(SURETY)

By: _____

By: _____

Printed Name & Title: _____

Printed Name & Title: _____

Surety's Address: _____

Surety's Telephone Number: _____

Surety's Fax Number: _____

NAME OF SURETY'S AGENT

Surety's Agent's Address: _____

Surety's Agent's Telephone Number: _____

Surety's Agent's Fax Number: _____

BID BOND

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:

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

hereinafter called the Obligee, in the sum of:

_____ 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 and effect.

SIGNED SEALED AND DATED 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

**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 be 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.

INVITATION FOR BID

SOLICITATION NUMBER 2024-3004

On **February 29, 2024**, at **10:00 a.m.**, the Cincinnati Metropolitan Housing Authority (CMHA) will receive, open and read aloud all bids on the project heretofore described as:

Project Name: Beechwood RAD Conversion Renovations

Contact: All questions concerning this solicitation are to be directed in writing to Mike Koch via email at Michael.koch@cintimha.com. Responses to questions received prior to 4:00pm (local time) on February 16, 2024 will be posted as an addendum to the CMHA website at www.cintimha.com. It is the responsibility of all bidders to monitor the website and review all addenda posted associated with this bid. Responses for questions received after this date and time will be posted at CMHA's discretion.

Proposals shall be delivered to: Cincinnati Metropolitan Housing Authority
1627 Western Ave
Cincinnati, Ohio 45214

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.

On **January 10, 2024**, bidders may download the plans and specifications from the CMHA website at www.cintimha.com. Bidders may also purchase the project manual from **ARC Document Solutions, 7157 Kemper Road Cincinnati, Ohio 45242** for a non-refundable fee (cash, Visa, personal check or money order). The project manual must be ordered in advance from ARC Document Solutions by calling **(513) 326-2300**. For a list of plan holders, go to www.e-arc.com. You may review a set of documents at no charge, at the CMHA, 1627 Western Avenue, Cincinnati, Ohio 45214, Phone: (513) 333-0670 during the hours of 9:00 a.m.- 4:00 p.m., Monday thru Friday.

There will be an optional **pre-bid walk through on January 25, 2024 at 10:00 A.M.** Meet at 330 Forest Ave., Cincinnati, OH 45229.

CINCINNATI METROPOLITAN HOUSING AUTHORITY
Gregory D. Johnson, MS, PHM, EDEP, Chief Executive Officer

Advertisement Dates: January 10, 2024 and January 17, 2024

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

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. HUD Form 2530
 5. Disclosure of Lobbying Activities
 6. HUD 5369A
 7. MBE Forms
 8. Attachment A - MBE Certification
 9. Section 3 Forms
 10. Contract
 11. Wage Decision Form
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 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 year 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 ninety (90) 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, b and c:

- a. All bid guarantees to be a minimum of 10% of the bid amount.
- b. 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.
- c. 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 paragraph 16.1 of the CMHA General Terms and 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 be posted as addendum to the CMHA website at www.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.

12. Add paragraph 18. Definitions

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.

13. 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



Lead-Based Paint Inspection Report

Prepared for:

Bureau Veritas North America

10461 Mill Run Circle, Ste 1100
Owings Mills, MD 21117

Property:

Beechwood Apartments

330 Forest Avenue
Cincinnati, Ohio

Owner:

Cincinnati Metropolitan Housing Authority (CMHA)

1627 Western Avenue, Cincinnati, Ohio 45214
513-721-4580

Inspection Dates: January 25-28, 2021

Lead Risk Assessor:

Charles McKee

State of Ohio Lead Risk Assessor #LA009106

Project #20RN2260

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DISCLOSURE REQUIREMENT

Ohio law (section 5302.30 of the Revised Code) requires every person who intends to transfer any residential real property by sale, land installment contract, lease with option to purchase, exchange, or lease for a term of ninety-nine years and renewable forever, to complete and provide a copy to the prospective transferee of the applicable property disclosure forms, disclosing known hazardous conditions of the property, including lead-based paint hazards

Federal law (24 C.F.R. part 35 and 40 C.F.R. part 745) requires sellers and lessors of residential units constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any child who is less than six years of age resides or is expected to reside in such housing) or any zero-bedroom dwelling to disclose and provide a copy of this report to new purchasers or lessees before they become obligated under a lease or sales contract. Property owners and sellers are also required to distribute an educational pamphlet approved by the United States environmental protection agency and include standard warning language in leases or sales contracts to ensure that parents have the information they need to protect children from lead-based paint hazards

"The results of this lead inspection indicate no lead in amounts greater than or equal to 1.0 mg/cm², 0.5 percent by weight, or 5,000 parts per million by weight, in paint was found on any building components of the residential unit using the lead inspection protocol in Chapter 7 of the HUD guidelines. Therefore, this residential unit qualifies for the exemption in 2 C.F.R. part 35 and 40 C.F.R. part 745 for target housing being leased is free of lead-based paint as defined in rule 3701-32-01 of the Administrative Code.

The Following Units were tested and were found to contain no lead in amounts greater than or equal to 1.0 mg/cm²:

Units Tested #								
209	302	308	402	410	509	602	607	609
610	709	803	807	813	902	905	912	1002
1007	1010	1102	1203	1204	1210	1305	1312	

In addition, based on the HUD protocols used for determining LBP in Multi-Family housing, all remaining untested units would also be considered to contain no lead in amounts greater than or equal to 1.0 mg/cm²

However, some painted surfaces may contain levels of lead below 1.0 mg/cm², 0.5 percent by weight, or 5,000 parts per million by weight which could create lead dust or lead-contaminated soil hazards if the paint is turned into dust by abrasion, scraping, or sanding. This report should be kept by the lead inspector and should also be kept by the owner and all future owners for the life of the structure or dwelling."

SECTION 1: EXECUTIVE SUMMARY

1.1 INTRODUCTION

A lead-based paint (LBP) inspection was conducted on January 25-28, 2021, at Beechwood Apartments, located at 330 Forest Avenue in Cincinnati, Ohio. The purpose of the inspection was to determine the presence and location of lead-based paint, as defined by the State of Ohio and the Environmental Protection Agency (EPA). Currently, the criteria for determining lead-based paint is 1.0 mg/cm². The inspection was accomplished using an x-ray fluorescence (XRF) lead-in-paint analyzer in each selected dwelling unit, common area, and building exterior.

The information in this report must be disclosed to all existing and new residents and to any new buyer in the future, under the Lead Disclosure Rule (24 CFR part 35, subpart A (HUD's rule) and 40 CFR part 745, subpart F (EPA's identical rule)).

1.2 SUMMARY OF LEAD-BASED PAINT INSPECTION AND VISUAL ASSESSMENT

The inspection determined that lead-based paint was present at the property on the date of the inspection.

Inspection & Visual Assessment Summary	
Lead-Based Paint Present	Yes
Deteriorated Lead-Based Paint above De Minimus Levels Present	No
Unless all lead-based paint is removed, RiskNomics recommends that the Owner implement or maintain an ongoing lead-based paint maintenance and re-evaluation program.	

1.3 PROPERTY-WIDE LOCATIONS OF BUILDING COMPONENTS WITH LEAD-BASED PAINT

In accordance with federal guidelines¹, RiskNomics tested a representative number of building components within the subject property for the presence of lead-based paint. Based on the results on this representative testing, RiskNomics identified three (3) components that are considered to contain lead-based paint on a property-wide basis. The property-wide components are listed in the Table below.

Table 1 Building Components with Lead-Based Paint		
Area	Component	Substrate
Exterior	Door Panel	Metal
Exterior	Window Panel	Metal

¹ HUD Guidelines for the Evaluation and Control of Lead Based Paint Hazards in Housing, Revised 2012.

Table 1		
Building Components with Lead-Based Paint		
Area	Component	Substrate
Commons	Window Panel	Metal

Within the table above, the following definitions apply: The “area” is the common location within the property (e.g., unit/apartment, office, common area, etc.); “components” are specific design or structural elements or fixtures of a building, residential dwelling, or child-occupied facility, that are distinguished from each other by form, function, and location; and the “substrate” is the building component material directly beneath the painted surface.

1.4 SUMMARY OF REGULATORY REQUIREMENTS AND RECOMMENDATIONS

Lead-based paint, as defined by EPA, was identified at the property.

RiskNomics recommends ongoing monitoring and maintenance of components identified as containing lead-based paint to prevent deterioration of these components and possible development of lead-based paint hazards in the future.

1.5 LEAD DISCLOSURE REQUIREMENTS

HUD and EPA regulations require the Owner to disclose the findings of this report to residents within a prescribed period, if lead-based paint is present. In addition, depending on the findings of the evaluation, an Owner may be required to conduct additional disclosure activities. Based on the findings of this evaluation, the following disclosure statement(s) apply:

Lead-based paint, as defined by EPA, was identified at the property.

The above disclosure statement, along with the information contained in Table 1, “Building Components with Lead-Based Paint”, must be provided to new lessees (residents) and purchasers of this property under Federal law (24 CFR part 35 and 40 CFR part 745) before they become obligated under a lease or sales contract.

This complete report must be provided at no charge to new purchasers, and to new residents, upon request. Landlords (lessors) and sellers are also required to distribute an educational pamphlet approved by EPA, and to include standard warning language in their leases or sales contracts. The specific warning language can be found at 24 CFR part 35.92.

The HUD and EPA Disclosure regulations apply to the property until written certification is obtained from a state licensed lead-based paint inspector, stating that the property is lead-based paint free. The lead-based paint free certification must meet all regulatory guidelines established by HUD, EPA and the state.

This report should be kept by the inspector or the inspection firm, the Owner, and all future Owners for the life of the dwelling.

Section 2: Lead-Based Paint Inspection Report

2.1 OVERVIEW OF THE INSPECTION

2.1.1 Introduction

A lead-based paint inspection and visual assessment was conducted at Beechwood Apartments, a multifamily residential property located at 330 Forest Avenue in Cincinnati, Ohio, on January 25-28, 2021. Mr. Charles McKee, a State of Ohio Lead Risk Assessor #LA009106, conducted the inspection which was performed using a Niton XLp 300, Serial #108531. Employee certifications are found in Appendix D.

The information contained in this inspection report can be used to assist the Owner in ensuring that a lead-hazard free environment is maintained, by either: 1) developing a plan for eliminating lead-based paint from the property, or 2) establishing or maintaining an ongoing lead-based paint maintenance and re-evaluation program, if needed.

2.1.2 Description of Property

Beechwood Apartments was reportedly constructed in 1969, and consists of one-hundred forty-six (146) units in one (1) high-rise residential building. Sidewalks, parking areas, and turf-covered areas constitute the remainder of the site. Common areas consist of hallways, laundries, trash rooms, pool room and restroom. A total of one-hundred forty-six (146) similar dwelling units, nineteen (19) common areas, and one (1) building exterior areas were considered for evaluation.

2.1.3 Similar Groups of Buildings

At the outset of this inspection, individual buildings were grouped into similar groups of buildings in accordance with the HUD Guidelines, Chapter 7. These buildings and exterior sites were grouped according to: 1) construction date, 2) construction type, and/or 3) written documentation or visual evidence of similar construction materials. All buildings at the property were defined as high-rise apartments buildings.

2.1.4 Random Selection Process

Selection of the specific dwelling units and common areas to be tested was accomplished using the HUD-defined selection process specified in the HUD Guidelines, Chapter 7. The table provided in Section V, "Inspections in Multifamily Housing," identifies the number of building apartments and common areas that must be randomly sampled. A comprehensive table that provides all units randomly selected, as well as substitutes, is provided herein in Appendix B. Units removed from the random selection process, including an explanation as to why they were removed, are also identified in Appendix B.

Using the HUD Random Selection Criteria, a statistically valid subset of dwelling units and common areas was randomly selected as being representative of all units and areas on the entire property. Only the randomly selected units and common areas were tested for the presence of lead-based paint.

2.2 LEAD REGULATORY LEVELS

The lead regulatory levels provided in Table 3 below were used when preparing this lead-based paint evaluation and when evaluating data collected.

TABLE 2 LEAD REGULATORY LEVELS		
	EPA Levels	Ohio Levels
Lead-Based Paint	1.0 mg/cm ² or 0.5% by weight (or 5,000 ppm)	1.0 mg/cm ² or 0.5% by weight (or 5,000 ppm)

2.3 LEAD-BASED PAINT INSPECTION

A lead-based paint inspection is an interior and exterior investigation to identify all lead-based paint on a surface-by-surface basis. This lead-based paint inspection was performed in accordance with HUD Guidelines in a total of twenty-six (26) similar dwelling units, nineteen (19) common areas, and one (1) building exterior area.

The lead-based paint inspection was accomplished using an x-ray fluorescence (XRF) lead-in-paint analyzer in each selected dwelling unit and common area. The XRF analyzer is designed to measure the lead content of surface coatings on a variety of building surfaces, substrates, and components. The measurement is rapid, nondestructive, and according to the manufacturer, capable of detecting lead concentrations within numerous layers of various surface coatings. The results of the inspection apply to all similar buildings and dwelling units within a similar group of buildings throughout the entire property. See Appendix A for complete building information.

XRF testing was performed on random testing combinations, except for interior walls, where 1-4 readings were taken. A testing combination is characterized by the room equivalent, the component type, and the substrate. A room equivalent is an identifiable part of a residence or building (e.g., room, foyer, house exterior, etc.). In addition, Wall "A" or "1" in each room is the wall where the front entrance door opening is located (or aligned with street). Going clockwise and facing Wall "A" or "1", Wall "B" or "2" will always be to your right, Wall "C" or "3" directly to the rear and Wall "D" or "4" to the left. Doors, windows and closets are designated as left, center or right depending on their location on the wall.

RiskNomics also conducted a visual assessment of all painted surfaces, as described below in Section 2.4.

The results of the inspection indicate that lead-based paint was found on the property.

As a general rule, care should be taken to maintain all paint intact and to minimize, contain, and clean up any dust generated from the disturbance of painted surfaces – even when paint has lead concentrations below the level the EPA and the State of Ohio define as lead-based paint. Additionally, care should be taken to minimize dust during disturbance of ceramic wall tiles that potentially contain lead.

Please refer to Appendix C for detailed analytical testing results for each distinct area or unit inspected. The appendices provide complete testing data (XRF Testing Results), a summary of surfaces and components identified with lead-based paint coatings (XRF Summary – Readings Positive for Lead-Based Paint), and a distribution report detailing specific components or surfaces with lead-based paint (Component Type Report).

2.4 PAINT CONDITION SURVEY AND PAINT-LEAD HAZARDS

HUD and EPA define the terms *deteriorated paint*, *intact paint*, and *de minimis (small or minimal) levels* when these terms are used to describe surface coating conditions. To aid in the interpretation of the paint condition information, please refer to the following HUD definitions and criteria for specific interior and exterior surfaces.

HUD Definitions		
Building Component(s)	Intact Paint	<i>De minimis (small or minimal) Levels of Deteriorated Paint</i>
Exterior components with large surface areas (siding, etc.)	Entire surface is intact	Deteriorated paint on less than or equal to 20 square feet (ft ²) of exterior surfaces
Interior components with large surface areas (walls, ceilings, etc.)	Entire surface is intact	Deteriorated paint is observed at less than or equal to 2 ft ² of surface in any one interior room or space
Component types with small surface areas (soffits, baseboards, trim, etc.)	Entire surface is intact	Deteriorated paint is observed at less than or equal to 10% of the total surface area of a component type with a small surface area
<i>Note: See 24 CFR 35.1350(d)(1)-(3) for complete information on de minimis (small or minimal) levels.</i>		

Deteriorated paint is defined as “any interior or exterior paint or other coating that is peeling, chipping, chalking, or cracking or any paint or coating located on an interior or exterior surface or fixture that is otherwise damaged or separated from the substrate.”

HUD uses the phrase “significant deterioration” to refer to deterioration greater than *de minimis* levels.

Paint conditions and exact locations of paint deterioration for specific tested dwelling units, common areas, and exteriors are reported in this document under Appendix C.

Areas and/or components coated with lead-based paint that are currently *intact* do not constitute a lead hazard if the components do not represent a friction or impact surface (e.g., the windowsill, or floor). However, lead-safe work practices should be used when dealing with any surfaces that are known or assumed to contain lead-based paint.

2.4.1 Paint-Lead Hazards

As of the date of the evaluation, paints throughout the interior and exterior of the structure were primarily intact. No deteriorated lead-based paint was identified on the property.

2.4.2 Option for Additional Testing

Additional testing may reduce requirements for lead hazard control. The requirements described in this report are based on lead evaluations for randomly selected areas. Untested areas are assumed similar to these randomly selected areas. The Owner is encouraged to consider the benefits of additional testing if it believes one of the following applies: 1) that untested areas are free of lead-based paint, or 2) that the results of this report show there are only a few surfaces with lead-based paint.

2.5 CONDITIONS AND LIMITATIONS—DISCLAIMER

RiskNomics (the Preparer) has performed this lead-based paint inspection in a thorough and professional manner consistent with commonly accepted industry standards. The Preparer cannot guarantee, and does not warrant, that this evaluation has identified all adverse environmental factors and/or conditions affecting this property on the date of the evaluation.

The results reported and conclusions reached by the Preparer are solely for the benefit of the Owner and residents. The results and opinions in this report, based solely on the conditions found at the property on the date of the evaluation, are valid only on that date.

The Preparer assumes no obligation to advise the client of any changes in any real or potential lead-based paint hazards at this residence beyond the date of the property evaluation.

This report was prepared by:

RiskNomics, LLC



Andrew J. Olcott

Vice President, Operations

SECTION 3: APPENDICES

Appendix A: Property Information

A-1: Site Specific Property Information

Appendix B: Summary of Random Selection of Units

B-1: Random Selection Detail by Unit

Appendix C: XRF Sampling

C-1: Component Type Report

C-2: XRF Testing Results

C-3: XRF Readings Positive for Lead

C-4: Performance Characteristic Sheets

Appendix D: Certifications, Licenses, and Accreditations

D-1: Lead-Based Paint Inspector/Risk Assessor's License/Certification Information

Appendix E: Lead and Lead Safety Resource Data

E-1: Glossary

E-2: Resources for Additional Information on Lead and Lead-Based Paint Hazards

Appendix A: Property Information

A-1: SITE SPECIFIC PROPERTY INFORMATION

Property Name: Beechwood Apartments
Address: 330 Forest Avenue
Cincinnati, Ohio

Building Address: 330 Forest Avenue
Cincinnati, Ohio

Construction Date: 1969

Total # of Units: 146

of Units Evaluated: 26

INSPECTION FIRM INFORMATION

Firm: RiskNomics LLC.
Address: 8777 E. Via De Ventura, Suite 188
Scottsdale, Arizona 85258
(480) 315-1100

Risk Assessor: Charles McKee
License: #LA009106

Date of Evaluation: January 25-28, 2021

Date of Report: February 16, 2021

Appendix B: Summary of Random Selection of Units

B-1 Random Selection Detail by Unit

B-1: RANDOM SELECTION DETAIL BY UNIT

Beechwood Apts - Cincinnati, Ohio				
26 Units Selected for Lead Paint Survey				
	Random #	Sequence	Unit #	
1	0.01881562	3	202	No Access
2	0.05528577	9	208	No Access
3	0.13506205	21	308	Done
4	0.18569492	28	402	Done
5	0.23673374	36	410	Done
6	0.26378539	40	413	No Access
7	0.31675223	48	509	Done
8	0.3483353	53	602	Done
9	0.38187271	58	607	Done
10	0.40535372	61	610	Done
11	0.48177184	73	709	Done
12	0.51705715	78	803	Done
13	0.54440676	82	807	Done
14	0.58556234	88	813	Done
15	0.59923237	90	902	Done
16	0.61624941	93	905	Done
17	0.65371571	99	912	Done
18	0.67513955	102	1002	Done
19	0.7104061	107	1007	Done
20	0.72818256	110	1010	Done
21	0.7553029	114	1101	No Access
22	0.8164493	123	1110	No Access
23	0.84678694	128	1203	Done
24	0.89491205	135	1210	Done
25	0.95005049	143	1305	Done
26	0.98980806	149	1312	Done
Alternates				
1	0.09686248	15	302	Done
2	0.85317349	129	1204	Done
3	0.39415469	60	609	Done
4	0.06395752	10	209	Done
5	0.43337998	66	702	No Access
6	0.76647985	115	1102	Done

APPENDIX C: XRF SAMPLING

C-1: Component Type Report

C-2: XRF Testing Results

C-3: XRF Readings Positive for Lead

C-4: Performance Characteristics Sheets (PCS)/ Summary Sheet

C-1: COMPONENT TYPE REPORT

Beechwood Apts Component Type Report								
Component Description	Location	Substrate	Number of Readings	Positive		Negative		Component Classification
				No.	Percent	No.	Percent	
Window Panel	Commons	Metal	4	1	25.00	3	75.00	Positive
Door Panel	Exteriors	Metal	1	1	100.00	0	0.00	Positive
Window Panel	Exteriors	Metal	2	2	100.00	0	0.00	Positive
Cabinet Components	Units	Wood	78	0	0.00	78	100.00	Negative
Ceiling	Units	Concrete	94	0	0.00	94	100.00	Negative
Closet Components	Units	Wood	104	0	0.00	104	100.00	Negative
Door	Units	Wood	120	0	0.00	120	100.00	Negative
Door Casing	Units	Metal	68	0	0.00	68	100.00	Negative
Electrical Panel Door	Units	Metal	26	0	0.00	26	100.00	Negative
Medicine Cabinet	Units	Metal	26	0	0.00	26	100.00	Negative
Radiator	Units	Metal	68	0	0.00	68	100.00	Negative
Shelf Components	Units	Wood	64	0	0.00	64	100.00	Negative
Vent	Units	Metal	26	0	0.00	26	100.00	Negative
Wall	Units	Brick	26	0	0.00	26	100.00	Negative
Wall	Units	Concrete	90	0	0.00	90	100.00	Negative
Wall	Units	Drywall	377	0	0.00	377	100.00	Negative
Window Casing	Units	Wood	42	0	0.00	42	100.00	Negative
Window Panel	Units	Metal	25	0	0.00	25	100.00	Negative
Window Sill	Units	Wood	42	0	0.00	42	100.00	Negative
Ceiling	Commons	Concrete	18	0	0.00	18	100.00	Negative
Closet Components	Commons	Wood	2	0	0.00	2	100.00	Negative
Door	Commons	Wood	24	0	0.00	24	100.00	Negative
Door Casing	Commons	Metal	24	0	0.00	24	100.00	Negative
Electrical Box	Commons	Metal	10	0	0.00	10	100.00	Negative
Elevator Door	Commons	Metal	10	0	0.00	10	100.00	Negative
Elevator Door Casing	Commons	Metal	10	0	0.00	10	100.00	Negative
Fire Extinguisher Box	Commons	Metal	10	0	0.00	10	100.00	Negative
Handrail	Commons	Wood	10	0	0.00	10	100.00	Negative
Pipe	Commons	Metal	4	0	0.00	4	100.00	Negative
Radiator	Commons	Metal	4	0	0.00	4	100.00	Negative
Radiator Base	Commons	Wood	10	0	0.00	10	100.00	Negative
Vent	Commons	Metal	10	0	0.00	10	100.00	Negative
Wall	Commons	Brick	127	0	0.00	127	100.00	Negative
Wall	Commons	Concrete	18	0	0.00	18	100.00	Negative
Wall	Commons	Drywall	2	0	0.00	2	100.00	Negative
Window Casing	Commons	Metal	2	0	0.00	2	100.00	Negative
Window Casing	Commons	Wood	4	0	0.00	4	100.00	Negative
Window Sill	Commons	Wood	4	0	0.00	4	100.00	Negative
Door	Exteriors	Metal	3	0	0.00	3	100.00	Negative
Door Casing	Exteriors	Metal	1	0	0.00	1	100.00	Negative
Door Lintel	Exteriors	Metal	2	0	0.00	2	100.00	Negative
Handrail Components	Exteriors	Metal	4	0	0.00	4	100.00	Negative

Beechwood Apts Component Type Report								
Component Description	Location	Substrate	Number of Readings	Positive		Negative		Component Classification
				No.	Percent	No.	Percent	
Wall	Exteriors	Brick	4	0	0.00	4	100.00	Negative
Wall	Exteriors	Concrete	4	0	0.00	4	100.00	Negative
Window Casing	Exteriors	Metal	1	0	0.00	1	100.00	Negative

C-2: XRF TESTING RESULTS

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1	Apt # 1312	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
2	Apt # 1312	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
3	Apt # 1312	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
4	Apt # 1312	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
5	Apt # 1312	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
6	Apt # 1312	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.01	Negative
7	Apt # 1312	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.04	Negative
8	Apt # 1312	Kitchen/Entry	A	Door		Wood	Intact	Beige	0	Negative
9	Apt # 1312	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0	Negative
10	Apt # 1312	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0.02	Negative
11	Apt # 1312	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
12	Apt # 1312	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
13	Apt # 1312	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
14	Apt # 1312	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
15	Apt # 1312	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0	Negative
16	Apt # 1312	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0.02	Negative
17	Apt # 1312	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0	Negative
18	Apt # 1312	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
19	Apt # 1312	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
20	Apt # 1312	Living Room	B	Wall		Concrete	Intact	Beige	0	Negative
21	Apt # 1312	Living Room	C	Wall		Drywall	Intact	Beige	0.06	Negative
22	Apt # 1312	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
23	Apt # 1312	Living Room	-	Ceiling		Concrete	Intact	White	0.01	Negative
24	Apt # 1312	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
25	Apt # 1312	Living Room	C	Radiator		Metal	Intact	White	0	Negative
26	Apt # 1312	Living Room	C	Window	Sill	Wood	Intact	White	0.02	Negative
27	Apt # 1312	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
28	Apt # 1312	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
29	Apt # 1312	Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
30	Apt # 1312	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
31	Apt # 1312	Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
32	Apt # 1312	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
33	Apt # 1312	Bedroom	D	Wall		Concrete	Intact	Beige	0.19	Negative
34	Apt # 1312	Bedroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
35	Apt # 1312	Bedroom	A	Door		Wood	Intact	White	0	Negative
36	Apt # 1312	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
37	Apt # 1312	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
38	Apt # 1312	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.02	Negative
39	Apt # 1312	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
40	Apt # 1312	Bedroom	C	Radiator		Metal	Intact	White	0	Negative
41	Apt # 1312	Bedroom	C	Window	Sill	Wood	Intact	White	0.03	Negative
42	Apt # 1312	Bedroom	C	Window	Casing	Wood	Intact	White	0.01	Negative
43	Apt # 1312	Bedroom	D	Shelf		Wood	Intact	Varnish	0	Negative
44	Apt # 1312	Bedroom	D	Shelf	Support	Wood	Intact	White	0	Negative
45	Apt # 1312	Bathroom	A	Wall		Drywall	Intact	Beige	0.02	Negative
46	Apt # 1312	Bathroom	A	Wall		Concrete	Intact	Beige	0.03	Negative
47	Apt # 1312	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
48	Apt # 1312	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
49	Apt # 1312	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
50	Apt # 1312	Bathroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
51	Apt # 1312	Bathroom	B	Door		Wood	Intact	White	0	Negative
52	Apt # 1312	Bathroom	B	Door	Casing	Metal	Intact	White	0	Negative
53	Apt # 1312	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
54	Apt # 1312	Bathroom	D	Vent		Metal	Intact	White	0.01	Negative
55	Apt # 1312	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0	Negative
56	Apt # 1204	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.01	Negative
57	Apt # 1204	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.01	Negative
58	Apt # 1204	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
59	Apt # 1204	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
60	Apt # 1204	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
61	Apt # 1204	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.02	Negative
62	Apt # 1204	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
63	Apt # 1204	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.08	Negative
64	Apt # 1204	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.02	Negative
65	Apt # 1204	Kitchen/Entry	C	Shelf		Wood	Intact	White	0.01	Negative
66	Apt # 1204	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
67	Apt # 1204	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.04	Negative
68	Apt # 1204	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	-0.59	Negative
69	Apt # 1204	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0	Negative
70	Apt # 1204	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0	Negative
71	Apt # 1204	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0.21	Negative
72	Apt # 1204	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
73	Apt # 1204	Bathroom	A	Wall		Drywall	Intact	Beige	0.02	Negative
74	Apt # 1204	Bathroom	A	Wall		Concrete	Intact	Beige	0.01	Negative
75	Apt # 1204	Bathroom	B	Wall		Drywall	Intact	Orange	0.03	Negative
76	Apt # 1204	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
77	Apt # 1204	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
78	Apt # 1204	Bathroom	-	Ceiling		Concrete	Intact	White	0	Negative
79	Apt # 1204	Bathroom	D	Door		Wood	Intact	White	0.01	Negative
80	Apt # 1204	Bathroom	D	Door	Casing	Metal	Intact	Orange	0.01	Negative
81	Apt # 1204	Bathroom	C	Radiator		Metal	Intact	White	0.02	Negative
82	Apt # 1204	Bathroom	B	Vent		Metal	Intact	White	0	Negative
83	Apt # 1204	Bathroom	B	Medicine Cabinet		Metal	Intact	Orange	0.07	Negative
84	Apt # 1204	Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
85	Apt # 1204	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
86	Apt # 1204	Bedroom	B	Wall		Concrete	Intact	Beige	-0.73	Negative
87	Apt # 1204	Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
88	Apt # 1204	Bedroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
89	Apt # 1204	Bedroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
90	Apt # 1204	Bedroom	A	Door		Wood	Intact	White	0	Negative
91	Apt # 1204	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
92	Apt # 1204	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0.03	Negative
93	Apt # 1204	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.01	Negative
94	Apt # 1204	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
95	Apt # 1204	Bedroom	C	Radiator		Metal	Intact	White	0	Negative
96	Apt # 1204	Bedroom	C	Window	Sill	Wood	Intact	White	-0.44	Negative
97	Apt # 1204	Bedroom	C	Window	Casing	Wood	Intact	White	0.02	Negative
98	Apt # 1204	Bedroom	B	Shelf		Wood	Intact	Varnish	0.04	Negative
99	Apt # 1204	Bedroom	B	Shelf	Support	Wood	Intact	White	0.01	Negative
100	Apt # 1204	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
101	Apt # 1204	Living Room	B	Wall		Drywall	Intact	Beige	0.12	Negative
102	Apt # 1204	Living Room	C	Wall		Drywall	Intact	Orange	0	Negative
103	Apt # 1204	Living Room	C	Wall		Drywall	Intact	Black	0.03	Negative
104	Apt # 1204	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
105	Apt # 1204	Living Room	D	Wall		Concrete	Intact	Beige	0.04	Negative
106	Apt # 1204	Living Room	-	Ceiling		Concrete	Intact	White	0	Negative
107	Apt # 1204	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
108	Apt # 1204	Living Room	C	Radiator		Metal	Intact	White	0	Negative
109	Apt # 1204	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
110	Apt # 1204	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
111	Apt # 1204	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
112	Apt # 1210	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.07	Negative
113	Apt # 1210	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.03	Negative
114	Apt # 1210	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
115	Apt # 1210	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
116	Apt # 1210	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.04	Negative
117	Apt # 1210	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
118	Apt # 1210	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
119	Apt # 1210	Kitchen/Entry	A	Door		Wood	Intact	White	0.1	Negative
120	Apt # 1210	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0	Negative
121	Apt # 1210	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0.4	Negative
122	Apt # 1210	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
123	Apt # 1210	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
124	Apt # 1210	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0	Negative
125	Apt # 1210	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
126	Apt # 1210	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0	Negative
127	Apt # 1210	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
128	Apt # 1210	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	-0.68	Negative
129	Apt # 1210	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0.05	Negative
130	Apt # 1210	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
131	Apt # 1210	Living Room/Bedroom	D	Wall		Concrete	Intact	Beige	0.01	Negative
132	Apt # 1210	Living Room/Bedroom	-	Ceiling		Concrete	Intact	White	0.02	Negative
133	Apt # 1210	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
134	Apt # 1210	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0	Negative
135	Apt # 1210	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
136	Apt # 1210	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
137	Apt # 1210	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0	Negative
138	Apt # 1210	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
139	Apt # 1210	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.01	Negative
140	Apt # 1210	Living	A	Closet	Shelf	Wood	Intact	White	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
		Room/Bedroom			Support					
141	Apt # 1210	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
142	Apt # 1210	Bathroom	A	Wall		Concrete	Intact	Beige	0.04	Negative
143	Apt # 1210	Bathroom	B	Wall		Drywall	Intact	Beige	-0.35	Negative
144	Apt # 1210	Bathroom	C	Wall		Drywall	Intact	Beige	-0.48	Negative
145	Apt # 1210	Bathroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
146	Apt # 1210	Bathroom	-	Ceiling		Concrete	Intact	White	0	Negative
147	Apt # 1210	Bathroom	B	Door		Wood	Intact	White	0	Negative
148	Apt # 1210	Bathroom	B	Door	Casing	Metal	Intact	White	0	Negative
149	Apt # 1210	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
150	Apt # 1210	Bathroom	D	Vent		Metal	Intact	White	0.09	Negative
151	Apt # 1210	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.01	Negative
152	Apt # 1203	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
153	Apt # 1203	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.02	Negative
154	Apt # 1203	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.04	Negative
155	Apt # 1203	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
156	Apt # 1203	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
157	Apt # 1203	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.02	Negative
158	Apt # 1203	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
159	Apt # 1203	Kitchen/Entry	A	Door		Wood	Intact	Beige	0	Negative
160	Apt # 1203	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0	Negative
161	Apt # 1203	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0.01	Negative
162	Apt # 1203	Kitchen/Entry	C	Shelf		Wood	Intact	White	0.08	Negative
163	Apt # 1203	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
164	Apt # 1203	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.08	Negative
165	Apt # 1203	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
166	Apt # 1203	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0.06	Negative
167	Apt # 1203	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
168	Apt # 1203	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0.01	Negative
169	Apt # 1203	Living Room	A	Wall		Drywall	Intact	Beige	0.02	Negative
170	Apt # 1203	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
171	Apt # 1203	Living Room	B	Wall		Concrete	Intact	Beige	0	Negative
172	Apt # 1203	Living Room	C	Wall		Drywall	Intact	Beige	0.01	Negative
173	Apt # 1203	Living Room	D	Wall		Drywall	Intact	Beige	0.01	Negative
174	Apt # 1203	Living Room	-	Ceiling		Concrete	Poor	White	0	Negative
175	Apt # 1203	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
176	Apt # 1203	Living Room	C	Radiator		Metal	Intact	White	0.4	Negative
177	Apt # 1203	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
178	Apt # 1203	Living Room	C	Window	Casing	Wood	Intact	White	0.01	Negative
179	Apt # 1203	Living Room	C	Window	Panel	Metal	Intact	Brown	0.01	Negative
180	Apt # 1203	Bedroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
181	Apt # 1203	Bedroom	B	Wall		Drywall	Intact	Beige	0.02	Negative
182	Apt # 1203	Bedroom	C	Wall		Drywall	Intact	Beige	-0.76	Negative
183	Apt # 1203	Bedroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
184	Apt # 1203	Bedroom	D	Wall		Concrete	Intact	Beige	0.04	Negative
185	Apt # 1203	Bedroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
186	Apt # 1203	Bedroom	A	Door		Wood	Intact	White	0.11	Negative
187	Apt # 1203	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
188	Apt # 1203	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
189	Apt # 1203	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
190	Apt # 1203	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.07	Negative
191	Apt # 1203	Bedroom	C	Radiator		Metal	Intact	White	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
192	Apt # 1203	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
193	Apt # 1203	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
194	Apt # 1203	Bedroom	D	Shelf		Wood	Intact	Varnish	0	Negative
195	Apt # 1203	Bedroom	D	Shelf	Support	Wood	Intact	White	-0.02	Negative
196	Apt # 1203	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
197	Apt # 1203	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
198	Apt # 1203	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
199	Apt # 1203	Bathroom	C	Wall		Drywall	Intact	Beige	0.02	Negative
200	Apt # 1203	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
201	Apt # 1203	Bathroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
202	Apt # 1203	Bathroom	B	Door		Wood	Intact	White	0	Negative
203	Apt # 1203	Bathroom	B	Door	Casing	Metal	Intact	White	0	Negative
204	Apt # 1203	Bathroom	C	Radiator		Metal	Intact	White	0.03	Negative
205	Apt # 1203	Bathroom	D	Vent		Metal	Intact	White	0	Negative
206	Apt # 1203	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.01	Negative
207	Apt # 1002	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.02	Negative
208	Apt # 1002	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.04	Negative
209	Apt # 1002	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
210	Apt # 1002	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.29	Negative
211	Apt # 1002	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.01	Negative
212	Apt # 1002	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
213	Apt # 1002	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.01	Negative
214	Apt # 1002	Kitchen/Entry	A	Door		Wood	Intact	White	0	Negative
215	Apt # 1002	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0.01	Negative
216	Apt # 1002	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
217	Apt # 1002	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
218	Apt # 1002	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
219	Apt # 1002	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0.01	Negative
220	Apt # 1002	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0	Negative
221	Apt # 1002	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0.01	Negative
222	Apt # 1002	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
223	Apt # 1002	Bathroom	A	Wall		Concrete	Intact	Beige	0.01	Negative
224	Apt # 1002	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
225	Apt # 1002	Bathroom	C	Wall		Drywall	Intact	Beige	0.03	Negative
226	Apt # 1002	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
227	Apt # 1002	Bathroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
228	Apt # 1002	Bathroom	D	Door		Wood	Intact	White	0	Negative
229	Apt # 1002	Bathroom	D	Door	Casing	Metal	Intact	White	0	Negative
230	Apt # 1002	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
231	Apt # 1002	Bathroom	B	Vent		Metal	Intact	White	-0.59	Negative
232	Apt # 1002	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0	Negative
233	Apt # 1002	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
234	Apt # 1002	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
235	Apt # 1002	Living Room/Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
236	Apt # 1002	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
237	Apt # 1002	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
238	Apt # 1002	Living Room/Bedroom	-	Ceiling		Concrete	Intact	White	-0.28	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
239	Apt # 1002	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
240	Apt # 1002	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0.01	Negative
241	Apt # 1002	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	-0.73	Negative
242	Apt # 1002	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0.04	Negative
243	Apt # 1002	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0	Negative
244	Apt # 1002	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0.09	Negative
245	Apt # 1002	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.06	Negative
246	Apt # 1002	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.04	Negative
247	Apt # 1010	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.5	Negative
248	Apt # 1010	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.02	Negative
249	Apt # 1010	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.03	Negative
250	Apt # 1010	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
251	Apt # 1010	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.01	Negative
252	Apt # 1010	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.01	Negative
253	Apt # 1010	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.01	Negative
254	Apt # 1010	Kitchen/Entry	A	Door		Wood	Intact	White	0	Negative
255	Apt # 1010	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0.01	Negative
256	Apt # 1010	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0	Negative
257	Apt # 1010	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
258	Apt # 1010	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0.01	Negative
259	Apt # 1010	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	-0.49	Negative
260	Apt # 1010	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
261	Apt # 1010	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0.03	Negative
262	Apt # 1010	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
263	Apt # 1010	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
264	Apt # 1010	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
265	Apt # 1010	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
266	Apt # 1010	Living Room/Bedroom	D	Wall		Concrete	Intact	Beige	0.04	Negative
267	Apt # 1010	Living Room/Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
268	Apt # 1010	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
269	Apt # 1010	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0.01	Negative
270	Apt # 1010	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0.04	Negative
271	Apt # 1010	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
272	Apt # 1010	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0.01	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
273	Apt # 1010	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
274	Apt # 1010	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
275	Apt # 1010	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.01	Negative
276	Apt # 1010	Bathroom	A	Wall		Drywall	Intact	Beige	0.02	Negative
277	Apt # 1010	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
278	Apt # 1010	Bathroom	B	Wall		Drywall	Intact	Beige	-0.62	Negative
279	Apt # 1010	Bathroom	C	Wall		Drywall	Intact	Beige	0.02	Negative
280	Apt # 1010	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
281	Apt # 1010	Bathroom	-	Ceiling		Concrete	Intact	White	-0.32	Negative
282	Apt # 1010	Bathroom	B	Door		Wood	Intact	White	0.02	Negative
283	Apt # 1010	Bathroom	B	Door	Casing	Metal	Intact	White	0.01	Negative
284	Apt # 1010	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
285	Apt # 1010	Bathroom	D	Vent		Metal	Intact	White	0.02	Negative
286	Apt # 1010	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.21	Negative
287	Apt # 905	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.02	Negative
288	Apt # 905	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.05	Negative
289	Apt # 905	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
290	Apt # 905	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
291	Apt # 905	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
292	Apt # 905	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
293	Apt # 905	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
294	Apt # 905	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.01	Negative
295	Apt # 905	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.04	Negative
296	Apt # 905	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0.01	Negative
297	Apt # 905	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
298	Apt # 905	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
299	Apt # 905	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
300	Apt # 905	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
301	Apt # 905	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0	Negative
302	Apt # 905	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
303	Apt # 905	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0	Negative
304	Apt # 905	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
305	Apt # 905	Living Room	B	Wall		Drywall	Intact	Beige	-0.19	Negative
306	Apt # 905	Living Room	B	Wall		Concrete	Intact	Beige	0.06	Negative
307	Apt # 905	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
308	Apt # 905	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
309	Apt # 905	Living Room	-	Ceiling		Concrete	Intact	White	0	Negative
310	Apt # 905	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0.03	Negative
311	Apt # 905	Living Room	C	Radiator		Metal	Intact	White	0.03	Negative
312	Apt # 905	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
313	Apt # 905	Living Room	C	Window	Casing	Wood	Intact	White	0.01	Negative
314	Apt # 905	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
315	Apt # 905	Bedroom	A	Wall		Drywall	Intact	Beige	0.05	Negative
316	Apt # 905	Bedroom	B	Wall		Drywall	Intact	Beige	0.11	Negative
317	Apt # 905	Bedroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
318	Apt # 905	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
319	Apt # 905	Bedroom	D	Wall		Concrete	Intact	Beige	0.01	Negative
320	Apt # 905	Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
321	Apt # 905	Bedroom	A	Door		Wood	Intact	White	0.02	Negative
322	Apt # 905	Bedroom	A	Door	Casing	Metal	Intact	White	0.01	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
323	Apt # 905	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
324	Apt # 905	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.03	Negative
325	Apt # 905	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.01	Negative
326	Apt # 905	Bedroom	C	Radiator		Metal	Intact	White	0	Negative
327	Apt # 905	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
328	Apt # 905	Bedroom	C	Window	Casing	Wood	Intact	White	0.03	Negative
329	Apt # 905	Bedroom	D	Shelf		Wood	Intact	White	-0.47	Negative
330	Apt # 905	Bedroom	D	Shelf	Support	Wood	Intact	White	0.08	Negative
331	Apt # 905	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
332	Apt # 905	Bathroom	A	Wall		Concrete	Intact	Beige	0.07	Negative
333	Apt # 905	Bathroom	B	Wall		Drywall	Intact	Beige	0.05	Negative
334	Apt # 905	Bathroom	C	Wall		Drywall	Intact	Beige	0.04	Negative
335	Apt # 905	Bathroom	D	Wall		Drywall	Intact	Beige	0.05	Negative
336	Apt # 905	Bathroom	-	Ceiling		Concrete	Intact	White	0.5	Negative
337	Apt # 905	Bathroom	B	Door		Wood	Intact	White	0.01	Negative
338	Apt # 905	Bathroom	B	Door	Casing	Metal	Intact	White	0.03	Negative
339	Apt # 905	Bathroom	C	Radiator		Metal	Intact	White	0.05	Negative
340	Apt # 905	Bathroom	D	Vent		Metal	Intact	White	0.02	Negative
341	Apt # 905	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.11	Negative
342	Apt # 813	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
343	Apt # 813	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.02	Negative
344	Apt # 813	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.01	Negative
345	Apt # 813	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
346	Apt # 813	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
347	Apt # 813	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.01	Negative
348	Apt # 813	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.08	Negative
349	Apt # 813	Kitchen/Entry	A	Door		Wood	Intact	Beige	0	Negative
350	Apt # 813	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.01	Negative
351	Apt # 813	Kitchen/Entry	C	Shelf		Wood	Intact	White	0.03	Negative
352	Apt # 813	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
353	Apt # 813	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.02	Negative
354	Apt # 813	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
355	Apt # 813	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0.01	Negative
356	Apt # 813	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0	Negative
357	Apt # 813	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0	Negative
358	Apt # 813	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
359	Apt # 813	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
360	Apt # 813	Bathroom	A	Wall		Concrete	Intact	Beige	0.02	Negative
361	Apt # 813	Bathroom	B	Wall		Drywall	Intact	Beige	0.02	Negative
362	Apt # 813	Bathroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
363	Apt # 813	Bathroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
364	Apt # 813	Bathroom	-	Ceiling		Concrete	Intact	White	0.05	Negative
365	Apt # 813	Bathroom	D	Door		Wood	Intact	White	0	Negative
366	Apt # 813	Bathroom	D	Door	Casing	Metal	Intact	White	-0.47	Negative
367	Apt # 813	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
368	Apt # 813	Bathroom	B	Vent		Metal	Intact	White	0	Negative
369	Apt # 813	Bathroom	B	Medicine Cabinet		Metal	Intact	Beige	0.06	Negative
370	Apt # 813	Bedroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
371	Apt # 813	Bedroom	B	Wall		Drywall	Intact	Beige	0.03	Negative
372	Apt # 813	Bedroom	B	Wall		Concrete	Intact	Beige	0.01	Negative
373	Apt # 813	Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
374	Apt # 813	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
375	Apt # 813	Bedroom	-	Ceiling		Concrete	Intact	White	0.2	Negative
376	Apt # 813	Bedroom	A	Door		Wood	Intact	White	0.09	Negative
377	Apt # 813	Bedroom	A	Door	Casing	Metal	Intact	White	0.02	Negative
378	Apt # 813	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0.02	Negative
379	Apt # 813	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.04	Negative
380	Apt # 813	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.09	Negative
381	Apt # 813	Bedroom	C	Radiator		Metal	Intact	White	0	Negative
382	Apt # 813	Bedroom	C	Window	Sill	Wood	Intact	White	0.01	Negative
383	Apt # 813	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
384	Apt # 813	Bedroom	B	Shelf		Wood	Intact	Varnish	0	Negative
385	Apt # 813	Bedroom	B	Shelf	Support	Wood	Intact	White	0	Negative
386	Apt # 813	Living Room	A	Wall		Drywall	Intact	Beige	0.01	Negative
387	Apt # 813	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
388	Apt # 813	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
389	Apt # 813	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
390	Apt # 813	Living Room	D	Wall		Concrete	Intact	Beige	0	Negative
391	Apt # 813	Living Room	-	Ceiling		Concrete	Intact	White	0	Negative
392	Apt # 813	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
393	Apt # 813	Living Room	C	Radiator		Metal	Intact	White	0	Negative
394	Apt # 813	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
395	Apt # 813	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
396	Apt # 813	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
397	Apt # 609	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
398	Apt # 609	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
399	Apt # 609	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
400	Apt # 609	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.03	Negative
401	Apt # 609	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.01	Negative
402	Apt # 609	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
403	Apt # 609	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
404	Apt # 609	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.01	Negative
405	Apt # 609	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.01	Negative
406	Apt # 609	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
407	Apt # 609	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
408	Apt # 609	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
409	Apt # 609	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
410	Apt # 609	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0.04	Negative
411	Apt # 609	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0	Negative
412	Apt # 609	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0	Negative
413	Apt # 609	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
414	Apt # 609	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
415	Apt # 609	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
416	Apt # 609	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
417	Apt # 609	Bathroom	C	Wall		Drywall	Intact	Beige	0.03	Negative
418	Apt # 609	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
419	Apt # 609	Bathroom	-	Ceiling		Concrete	Intact	White	0	Negative
420	Apt # 609	Bathroom	D	Door		Wood	Intact	White	0	Negative
421	Apt # 609	Bathroom	D	Door	Casing	Metal	Intact	White	0	Negative
422	Apt # 609	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
423	Apt # 609	Bathroom	B	Vent		Metal	Intact	White	-0.32	Negative
424	Apt # 609	Bathroom	B	Medicine Cabinet		Metal	Intact	Beige	0	Negative
425	Apt # 609	Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
426	Apt # 609	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
427	Apt # 609	Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
428	Apt # 609	Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
429	Apt # 609	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
430	Apt # 609	Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
431	Apt # 609	Bedroom	A	Door		Wood	Intact	White	0.01	Negative
432	Apt # 609	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
433	Apt # 609	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
434	Apt # 609	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
435	Apt # 609	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
436	Apt # 609	Bedroom	C	Radiator		Metal	Intact	White	0.01	Negative
437	Apt # 609	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
438	Apt # 609	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
439	Apt # 609	Bedroom	B	Shelf		Wood	Intact	Varnish	0.03	Negative
440	Apt # 609	Bedroom	B	Shelf	Support	Wood	Intact	White	0	Negative
441	Apt # 609	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
442	Apt # 609	Living Room	B	Wall		Drywall	Intact	Beige	0.01	Negative
443	Apt # 609	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
444	Apt # 609	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
445	Apt # 609	Living Room	-	Ceiling		Concrete	Intact	White	0	Negative
446	Apt # 609	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
447	Apt # 609	Living Room	C	Radiator		Metal	Intact	White	0	Negative
448	Apt # 609	Living Room	C	Window	Sill	Wood	Intact	White	0.01	Negative
449	Apt # 609	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
450	Apt # 609	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
451	Apt # 509	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
452	Apt # 509	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.01	Negative
453	Apt # 509	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
454	Apt # 509	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.03	Negative
455	Apt # 509	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
456	Apt # 509	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
457	Apt # 509	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
458	Apt # 509	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.4	Negative
459	Apt # 509	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.1	Negative
460	Apt # 509	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
461	Apt # 509	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
462	Apt # 509	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.02	Negative
463	Apt # 509	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
464	Apt # 509	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0	Negative
465	Apt # 509	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0	Negative
466	Apt # 509	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0	Negative
467	Apt # 509	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
468	Apt # 509	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
469	Apt # 509	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
470	Apt # 509	Bathroom	B	Wall		Drywall	Intact	Beige	-0.11	Negative
471	Apt # 509	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
472	Apt # 509	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
473	Apt # 509	Bathroom	-	Ceiling		Concrete	Intact	White	0	Negative
474	Apt # 509	Bathroom	D	Door		Wood	Intact	White	0.21	Negative
475	Apt # 509	Bathroom	D	Door	Casing	Metal	Intact	White	0	Negative
476	Apt # 509	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
477	Apt # 509	Bathroom	B	Vent		Metal	Intact	White	0	Negative
478	Apt # 509	Bathroom	B	Medicine Cabinet		Metal	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
479	Apt # 509	Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
480	Apt # 509	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
481	Apt # 509	Bedroom	B	Wall		Concrete	Intact	Beige	0.06	Negative
482	Apt # 509	Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
483	Apt # 509	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
484	Apt # 509	Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
485	Apt # 509	Bedroom	A	Door		Wood	Intact	White	0	Negative
486	Apt # 509	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
487	Apt # 509	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0.02	Negative
488	Apt # 509	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
489	Apt # 509	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
490	Apt # 509	Bedroom	C	Radiator		Metal	Intact	White	0	Negative
491	Apt # 509	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
492	Apt # 509	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
493	Apt # 509	Bedroom	B	Shelf		Wood	Intact	White	0.01	Negative
494	Apt # 509	Bedroom	B	Shelf	Support	Wood	Intact	White	0	Negative
495	Apt # 509	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
496	Apt # 509	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
497	Apt # 509	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
498	Apt # 509	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
499	Apt # 509	Living Room	-	Ceiling		Concrete	Intact	White	0	Negative
500	Apt # 509	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0.04	Negative
501	Apt # 509	Living Room	C	Radiator		Metal	Intact	White	0	Negative
502	Apt # 509	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
503	Apt # 509	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
504	Apt # 509	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
505	Apt # 803	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
506	Apt # 803	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.06	Negative
507	Apt # 803	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.02	Negative
508	Apt # 803	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.02	Negative
509	Apt # 803	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
510	Apt # 803	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.06	Negative
511	Apt # 803	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
512	Apt # 803	Kitchen/Entry	A	Door		Wood	Intact	Beige	0	Negative
513	Apt # 803	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0	Negative
514	Apt # 803	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0.03	Negative
515	Apt # 803	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
516	Apt # 803	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
517	Apt # 803	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
518	Apt # 803	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
519	Apt # 803	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0	Negative
520	Apt # 803	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
521	Apt # 803	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0.01	Negative
522	Apt # 803	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
523	Apt # 803	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
524	Apt # 803	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
525	Apt # 803	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
526	Apt # 803	Living Room	-	Ceiling		Concrete	Poor	White	0.12	Negative
527	Apt # 803	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0.04	Negative
528	Apt # 803	Living Room	C	Radiator		Metal	Intact	White	0.04	Negative
529	Apt # 803	Living Room	C	Window	Sill	Wood	Intact	White	0.02	Negative
530	Apt # 803	Living Room	C	Window	Casing	Wood	Intact	White	0.03	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
531	Apt # 803	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
532	Apt # 803	Bedroom	A	Wall		Drywall	Intact	Beige	0.02	Negative
533	Apt # 803	Bedroom	B	Wall		Drywall	Intact	Beige	-0.39	Negative
534	Apt # 803	Bedroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
535	Apt # 803	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
536	Apt # 803	Bedroom	D	Wall		Concrete	Intact	Beige	0.01	Negative
537	Apt # 803	Bedroom	-	Ceiling		Concrete	Intact	White	0.03	Negative
538	Apt # 803	Bedroom	A	Door		Wood	Intact	White	0	Negative
539	Apt # 803	Bedroom	A	Door	Casing	Metal	Intact	White	0.02	Negative
540	Apt # 803	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0.04	Negative
541	Apt # 803	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.01	Negative
542	Apt # 803	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
543	Apt # 803	Bedroom	C	Radiator		Metal	Intact	White	0.01	Negative
544	Apt # 803	Bedroom	C	Window	Sill	Wood	Intact	White	0.03	Negative
545	Apt # 803	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
546	Apt # 803	Bedroom	D	Shelf		Wood	Intact	Varnish	0.01	Negative
547	Apt # 803	Bedroom	D	Shelf	Support	Wood	Intact	White	0.04	Negative
548	Apt # 803	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
549	Apt # 803	Bathroom	A	Wall		Concrete	Intact	Beige	0.01	Negative
550	Apt # 803	Bathroom	B	Wall		Drywall	Intact	Beige	0.15	Negative
551	Apt # 803	Bathroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
552	Apt # 803	Bathroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
553	Apt # 803	Bathroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
554	Apt # 803	Bathroom	B	Door		Wood	Intact	White	0.04	Negative
555	Apt # 803	Bathroom	B	Door	Casing	Metal	Intact	White	0.04	Negative
556	Apt # 803	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
557	Apt # 803	Bathroom	D	Vent		Metal	Intact	White	0.5	Negative
558	Apt # 803	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.01	Negative
559	Apt # 610	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
560	Apt # 610	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
561	Apt # 610	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.08	Negative
562	Apt # 610	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.02	Negative
563	Apt # 610	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
564	Apt # 610	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
565	Apt # 610	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.01	Negative
566	Apt # 610	Kitchen/Entry	A	Door		Wood	Intact	White	0	Negative
567	Apt # 610	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0.09	Negative
568	Apt # 610	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0	Negative
569	Apt # 610	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
570	Apt # 610	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
571	Apt # 610	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0.03	Negative
572	Apt # 610	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
573	Apt # 610	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0.02	Negative
574	Apt # 610	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0.03	Negative
575	Apt # 610	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0.14	Negative
576	Apt # 610	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0.03	Negative
577	Apt # 610	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
578	Apt # 610	Living	D	Wall		Concrete	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
		Room/Bedroom								
579	Apt # 610	Living Room/Bedroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
580	Apt # 610	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0.02	Negative
581	Apt # 610	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0	Negative
582	Apt # 610	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
583	Apt # 610	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0.01	Negative
584	Apt # 610	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0	Negative
585	Apt # 610	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
586	Apt # 610	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	White	0.01	Negative
587	Apt # 610	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.01	Negative
588	Apt # 610	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
589	Apt # 610	Bathroom	A	Wall		Concrete	Intact	Beige	0.09	Negative
590	Apt # 610	Bathroom	B	Wall		Drywall	Intact	Beige	0.01	Negative
591	Apt # 610	Bathroom	C	Wall		Drywall	Intact	Beige	0.04	Negative
592	Apt # 610	Bathroom	D	Wall		Drywall	Intact	Beige	0.7	Negative
593	Apt # 610	Bathroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
594	Apt # 610	Bathroom	B	Door		Wood	Intact	White	0	Negative
595	Apt # 610	Bathroom	B	Door	Casing	Metal	Intact	White	0	Negative
596	Apt # 610	Bathroom	C	Radiator		Metal	Intact	White	0.02	Negative
597	Apt # 610	Bathroom	D	Vent		Metal	Intact	White	-0.21	Negative
598	Apt # 610	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0	Negative
599	Apt # 607	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.01	Negative
600	Apt # 607	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.01	Negative
601	Apt # 607	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
602	Apt # 607	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
603	Apt # 607	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.05	Negative
604	Apt # 607	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.03	Negative
605	Apt # 607	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.01	Negative
606	Apt # 607	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.01	Negative
607	Apt # 607	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.01	Negative
608	Apt # 607	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
609	Apt # 607	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0.01	Negative
610	Apt # 607	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.05	Negative
611	Apt # 607	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	-0.6	Negative
612	Apt # 607	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0	Negative
613	Apt # 607	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0	Negative
614	Apt # 607	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0	Negative
615	Apt # 607	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
616	Apt # 607	Bathroom	A	Wall		Drywall	Intact	Beige	0.05	Negative
617	Apt # 607	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
618	Apt # 607	Bathroom	B	Wall		Drywall	Intact	Beige	0.01	Negative
619	Apt # 607	Bathroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
620	Apt # 607	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
621	Apt # 607	Bathroom	-	Ceiling		Concrete	Intact	White	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
622	Apt # 607	Bathroom	D	Door		Wood	Intact	White	0.02	Negative
623	Apt # 607	Bathroom	D	Door	Casing	Metal	Intact	White	0.01	Negative
624	Apt # 607	Bathroom	C	Radiator		Metal	Intact	White	0.02	Negative
625	Apt # 607	Bathroom	B	Vent		Metal	Intact	White	0.02	Negative
626	Apt # 607	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0	Negative
627	Apt # 607	Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
628	Apt # 607	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
629	Apt # 607	Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
630	Apt # 607	Bedroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
631	Apt # 607	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
632	Apt # 607	Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
633	Apt # 607	Bedroom	A	Door		Wood	Intact	White	0.01	Negative
634	Apt # 607	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
635	Apt # 607	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
636	Apt # 607	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.03	Negative
637	Apt # 607	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.06	Negative
638	Apt # 607	Bedroom	C	Radiator		Metal	Intact	White	0	Negative
639	Apt # 607	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
640	Apt # 607	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
641	Apt # 607	Bedroom	B	Shelf		Wood	Intact	Varnish	0.06	Negative
642	Apt # 607	Bedroom	B	Shelf	Support	Wood	Intact	White	0	Negative
643	Apt # 607	Living Room	A	Wall		Drywall	Intact	Beige	0.01	Negative
644	Apt # 607	Living Room	B	Wall		Drywall	Intact	Beige	0.06	Negative
645	Apt # 607	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
646	Apt # 607	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
647	Apt # 607	Living Room	D	Wall		Concrete	Intact	Beige	0	Negative
648	Apt # 607	Living Room	-	Ceiling		Concrete	Intact	White	0.01	Negative
649	Apt # 607	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
650	Apt # 607	Living Room	C	Radiator		Metal	Intact	White	0	Negative
651	Apt # 607	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
652	Apt # 607	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
653	Apt # 607	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
654	Apt # 602	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.01	Negative
655	Apt # 602	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
656	Apt # 602	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.01	Negative
657	Apt # 602	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
658	Apt # 602	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	-0.21	Negative
659	Apt # 602	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.02	Negative
660	Apt # 602	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.05	Negative
661	Apt # 602	Kitchen/Entry	A	Door		Wood	Intact	White	0.08	Negative
662	Apt # 602	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0.01	Negative
663	Apt # 602	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0.5	Negative
664	Apt # 602	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.02	Negative
665	Apt # 602	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0.01	Negative
666	Apt # 602	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0.04	Negative
667	Apt # 602	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0	Negative
668	Apt # 602	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	-0.19	Negative
669	Apt # 602	Bathroom	A	Wall		Drywall	Intact	Beige	0.06	Negative
670	Apt # 602	Bathroom	A	Wall		Concrete	Intact	Beige	0.01	Negative
671	Apt # 602	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
672	Apt # 602	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
673	Apt # 602	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
674	Apt # 602	Bathroom	-	Ceiling		Concrete	Intact	White	0.02	Negative
675	Apt # 602	Bathroom	D	Door		Wood	Intact	White	0	Negative
676	Apt # 602	Bathroom	D	Door	Casing	Metal	Intact	White	0.03	Negative
677	Apt # 602	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
678	Apt # 602	Bathroom	B	Vent		Metal	Intact	White	0.02	Negative
679	Apt # 602	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0.06	Negative
680	Apt # 602	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
681	Apt # 602	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
682	Apt # 602	Living Room/Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
683	Apt # 602	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
684	Apt # 602	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
685	Apt # 602	Living Room/Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
686	Apt # 602	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
687	Apt # 602	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0	Negative
688	Apt # 602	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0.04	Negative
689	Apt # 602	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0.01	Negative
690	Apt # 602	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0	Negative
691	Apt # 602	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
692	Apt # 602	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
693	Apt # 602	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
694	Apt # 1305	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.05	Negative
695	Apt # 1305	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
696	Apt # 1305	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.02	Negative
697	Apt # 1305	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
698	Apt # 1305	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.01	Negative
699	Apt # 1305	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.01	Negative
700	Apt # 1305	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.01	Negative
701	Apt # 1305	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.01	Negative
702	Apt # 1305	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0	Negative
703	Apt # 1305	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0	Negative
704	Apt # 1305	Kitchen/Entry	C	Shelf		Wood	Intact	Varnish	0.01	Negative
705	Apt # 1305	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
706	Apt # 1305	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.07	Negative
707	Apt # 1305	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0.01	Negative
708	Apt # 1305	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0	Negative
709	Apt # 1305	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	White	0	Negative
710	Apt # 1305	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0	Negative
711	Apt # 1305	Living Room	A	Wall		Drywall	Intact	Beige	0.01	Negative
712	Apt # 1305	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
713	Apt # 1305	Living Room	B	Wall		Concrete	Intact	Beige	0.01	Negative
714	Apt # 1305	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
715	Apt # 1305	Living Room	D	Wall		Drywall	Intact	Beige	0.4	Negative
716	Apt # 1305	Living Room	-	Ceiling		Concrete	Intact	White	0	Negative
717	Apt # 1305	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
718	Apt # 1305	Living Room	C	Radiator		Metal	Intact	White	0	Negative
719	Apt # 1305	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
720	Apt # 1305	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
721	Apt # 1305	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
722	Apt # 1305	Bedroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
723	Apt # 1305	Bedroom	B	Wall		Drywall	Intact	Beige	0.05	Negative
724	Apt # 1305	Bedroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
725	Apt # 1305	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
726	Apt # 1305	Bedroom	D	Wall		Concrete	Intact	Beige	0	Negative
727	Apt # 1305	Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
728	Apt # 1305	Bedroom	A	Door		Wood	Intact	White	0.01	Negative
729	Apt # 1305	Bedroom	A	Door	Casing	Metal	Intact	White	0.01	Negative
730	Apt # 1305	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0.01	Negative
731	Apt # 1305	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
732	Apt # 1305	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.02	Negative
733	Apt # 1305	Bedroom	C	Radiator		Metal	Intact	White	0.01	Negative
734	Apt # 1305	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
735	Apt # 1305	Bedroom	C	Window	Casing	Wood	Intact	White	0.01	Negative
736	Apt # 1305	Bedroom	D	Shelf		Wood	Intact	Varnish	0	Negative
737	Apt # 1305	Bedroom	D	Shelf	Support	Wood	Intact	White	0.03	Negative
738	Apt # 1305	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
739	Apt # 1305	Bathroom	A	Wall		Concrete	Intact	Beige	0.07	Negative
740	Apt # 1305	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
741	Apt # 1305	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
742	Apt # 1305	Bathroom	D	Wall		Drywall	Intact	Beige	0.06	Negative
743	Apt # 1305	Bathroom	-	Ceiling		Concrete	Intact	White	0.05	Negative
744	Apt # 1305	Bathroom	B	Door		Wood	Intact	White	0	Negative
745	Apt # 1305	Bathroom	B	Door	Casing	Metal	Intact	White	0.27	Negative
746	Apt # 1305	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
747	Apt # 1305	Bathroom	D	Vent		Metal	Intact	White	0	Negative
748	Apt # 1305	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.02	Negative
749	Apt # 1102	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
750	Apt # 1102	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.03	Negative
751	Apt # 1102	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
752	Apt # 1102	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
753	Apt # 1102	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
754	Apt # 1102	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
755	Apt # 1102	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
756	Apt # 1102	Kitchen/Entry	A	Door		Wood	Intact	White	0	Negative
757	Apt # 1102	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0	Negative
758	Apt # 1102	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
759	Apt # 1102	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.08	Negative
760	Apt # 1102	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
761	Apt # 1102	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0	Negative
762	Apt # 1102	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0.04	Negative
763	Apt # 1102	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0.03	Negative
764	Apt # 1102	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
765	Apt # 1102	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
766	Apt # 1102	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
767	Apt # 1102	Bathroom	C	Wall		Drywall	Intact	Beige	0.02	Negative
768	Apt # 1102	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
769	Apt # 1102	Bathroom	-	Ceiling		Concrete	Intact	White	0.02	Negative
770	Apt # 1102	Bathroom	D	Door		Wood	Intact	White	0.01	Negative
771	Apt # 1102	Bathroom	D	Door	Casing	Metal	Intact	White	0	Negative
772	Apt # 1102	Bathroom	C	Radiator		Metal	Intact	White	0.03	Negative
773	Apt # 1102	Bathroom	B	Vent		Metal	Intact	White	0	Negative
774	Apt # 1102	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0.01	Negative
775	Apt # 1102	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
776	Apt # 1102	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0.04	Negative
777	Apt # 1102	Living Room/Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
778	Apt # 1102	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0.7	Negative
779	Apt # 1102	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0.03	Negative
780	Apt # 1102	Living Room/Bedroom	-	Ceiling		Concrete	Intact	White	0.03	Negative
781	Apt # 1102	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
782	Apt # 1102	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0.01	Negative
783	Apt # 1102	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0.11	Negative
784	Apt # 1102	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
785	Apt # 1102	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0	Negative
786	Apt # 1102	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
787	Apt # 1102	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.01	Negative
788	Apt # 1102	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
789	Apt # 1007	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
790	Apt # 1007	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.04	Negative
791	Apt # 1007	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
792	Apt # 1007	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
793	Apt # 1007	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
794	Apt # 1007	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
795	Apt # 1007	Kitchen/Entry	-	Ceiling		Concrete	Poor	White	0.02	Negative
796	Apt # 1007	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.01	Negative
797	Apt # 1007	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.01	Negative
798	Apt # 1007	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
799	Apt # 1007	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0.02	Negative
800	Apt # 1007	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
801	Apt # 1007	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0.03	Negative
802	Apt # 1007	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0.02	Negative
803	Apt # 1007	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	White	0	Negative
804	Apt # 1007	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0.01	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
805	Apt # 1007	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
806	Apt # 1007	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
807	Apt # 1007	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
808	Apt # 1007	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
809	Apt # 1007	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
810	Apt # 1007	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
811	Apt # 1007	Bathroom	-	Ceiling		Concrete	Poor	White	0.02	Negative
812	Apt # 1007	Bathroom	D	Door		Wood	Intact	White	0.05	Negative
813	Apt # 1007	Bathroom	D	Door	Casing	Metal	Intact	White	0.01	Negative
814	Apt # 1007	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
815	Apt # 1007	Bathroom	B	Vent		Metal	Intact	White	0	Negative
816	Apt # 1007	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0	Negative
817	Apt # 1007	Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
818	Apt # 1007	Bedroom	B	Wall		Drywall	Intact	Beige	0.01	Negative
819	Apt # 1007	Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
820	Apt # 1007	Bedroom	C	Wall		Drywall	Intact	Beige	0.02	Negative
821	Apt # 1007	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
822	Apt # 1007	Bedroom	-	Ceiling		Concrete	Poor	White	0.02	Negative
823	Apt # 1007	Bedroom	A	Door		Wood	Intact	White	0.01	Negative
824	Apt # 1007	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
825	Apt # 1007	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
826	Apt # 1007	Bedroom	A	Closet	Shelf	Wood	Intact	White	0.01	Negative
827	Apt # 1007	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.04	Negative
828	Apt # 1007	Bedroom	C	Radiator		Metal	Intact	White	0.01	Negative
829	Apt # 1007	Bedroom	C	Window	Sill	Wood	Intact	White	0.08	Negative
830	Apt # 1007	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
831	Apt # 1007	Bedroom	B	Shelf		Wood	Intact	White	0	Negative
832	Apt # 1007	Bedroom	B	Shelf	Support	Wood	Intact	White	0.01	Negative
833	Apt # 1007	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
834	Apt # 1007	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
835	Apt # 1007	Living Room	C	Wall		Drywall	Intact	Beige	0.03	Negative
836	Apt # 1007	Living Room	D	Wall		Drywall	Intact	Beige	0	Negative
837	Apt # 1007	Living Room	D	Wall		Concrete	Intact	Beige	0	Negative
838	Apt # 1007	Living Room	-	Ceiling		Concrete	Poor	White	0	Negative
839	Apt # 1007	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
840	Apt # 1007	Living Room	C	Radiator		Metal	Intact	White	0.02	Negative
841	Apt # 1007	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
842	Apt # 1007	Living Room	C	Window	Casing	Wood	Intact	White	0.03	Negative
843	Apt # 1007	Living Room	C	Window	Panel	Metal	Intact	Brown	0.03	Negative
844	Apt # 912	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
845	Apt # 912	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.04	Negative
846	Apt # 912	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.07	Negative
847	Apt # 912	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
848	Apt # 912	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
849	Apt # 912	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.02	Negative
850	Apt # 912	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
851	Apt # 912	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.06	Negative
852	Apt # 912	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0	Negative
853	Apt # 912	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0	Negative
854	Apt # 912	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
855	Apt # 912	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0.06	Negative
856	Apt # 912	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
857	Apt # 912	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
858	Apt # 912	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0.01	Negative
859	Apt # 912	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
860	Apt # 912	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0	Negative
861	Apt # 912	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
862	Apt # 912	Living Room	B	Wall		Drywall	Intact	Beige	0.09	Negative
863	Apt # 912	Living Room	B	Wall		Concrete	Intact	Beige	0	Negative
864	Apt # 912	Living Room	C	Wall		Drywall	Intact	Beige	0.01	Negative
865	Apt # 912	Living Room	D	Wall		Drywall	Intact	Brown	0.02	Negative
866	Apt # 912	Living Room	-	Ceiling		Concrete	Poor	White	0.02	Negative
867	Apt # 912	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0.05	Negative
868	Apt # 912	Living Room	C	Radiator		Metal	Intact	White	0.01	Negative
869	Apt # 912	Living Room	C	Window	Sill	Wood	Intact	White	0.01	Negative
870	Apt # 912	Living Room	C	Window	Casing	Wood	Intact	White	0.09	Negative
871	Apt # 912	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
872	Apt # 912	Bedroom	A	Wall		Drywall	Intact	Beige	0.03	Negative
873	Apt # 912	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
874	Apt # 912	Bedroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
875	Apt # 912	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
876	Apt # 912	Bedroom	D	Wall		Concrete	Intact	Beige	0.01	Negative
877	Apt # 912	Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
878	Apt # 912	Bedroom	A	Door		Wood	Intact	White	0	Negative
879	Apt # 912	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
880	Apt # 912	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
881	Apt # 912	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
882	Apt # 912	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
883	Apt # 912	Bedroom	C	Radiator		Metal	Intact	White	0	Negative
884	Apt # 912	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
885	Apt # 912	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
886	Apt # 912	Bedroom	D	Shelf		Wood	Intact	Varnish	0	Negative
887	Apt # 912	Bedroom	D	Shelf	Support	Wood	Intact	White	0.01	Negative
888	Apt # 912	Bathroom	A	Wall		Drywall	Intact	Beige	0.08	Negative
889	Apt # 912	Bathroom	A	Wall		Concrete	Intact	Beige	0.04	Negative
890	Apt # 912	Bathroom	B	Wall		Drywall	Intact	Beige	0.02	Negative
891	Apt # 912	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
892	Apt # 912	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
893	Apt # 912	Bathroom	-	Ceiling		Concrete	Intact	White	0.02	Negative
894	Apt # 912	Bathroom	B	Door		Wood	Intact	White	0.02	Negative
895	Apt # 912	Bathroom	B	Door	Casing	Metal	Intact	White	0.01	Negative
896	Apt # 912	Bathroom	C	Radiator		Metal	Intact	White	0.09	Negative
897	Apt # 912	Bathroom	D	Vent		Metal	Intact	White	-0.27	Negative
898	Apt # 912	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.03	Negative
899	Apt # 902	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.04	Negative
900	Apt # 902	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
901	Apt # 902	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.01	Negative
902	Apt # 902	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
903	Apt # 902	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.03	Negative
904	Apt # 902	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.07	Negative
905	Apt # 902	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0.02	Negative
906	Apt # 902	Kitchen/Entry	A	Door		Wood	Intact	White	0.01	Negative
907	Apt # 902	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0.03	Negative
908	Apt # 902	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0.01	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
909	Apt # 902	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
910	Apt # 902	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
911	Apt # 902	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0	Negative
912	Apt # 902	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0	Negative
913	Apt # 902	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0.04	Negative
914	Apt # 902	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
915	Apt # 902	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
916	Apt # 902	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
917	Apt # 902	Bathroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
918	Apt # 902	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
919	Apt # 902	Bathroom	-	Ceiling		Concrete	Intact	White	0.05	Negative
920	Apt # 902	Bathroom	D	Door		Wood	Intact	White	0	Negative
921	Apt # 902	Bathroom	D	Door	Casing	Metal	Intact	White	0	Negative
922	Apt # 902	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
923	Apt # 902	Bathroom	B	Vent		Metal	Intact	White	0.01	Negative
924	Apt # 902	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0	Negative
925	Apt # 902	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0.02	Negative
926	Apt # 902	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0.01	Negative
927	Apt # 902	Living Room/Bedroom	B	Wall		Concrete	Intact	Beige	0.05	Negative
928	Apt # 902	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
929	Apt # 902	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
930	Apt # 902	Living Room/Bedroom	-	Ceiling		Concrete	Intact	White	0.01	Negative
931	Apt # 902	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
932	Apt # 902	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0	Negative
933	Apt # 902	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0.05	Negative
934	Apt # 902	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
935	Apt # 902	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0	Negative
936	Apt # 902	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
937	Apt # 902	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.01	Negative
938	Apt # 902	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.03	Negative
939	Apt # 807	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
940	Apt # 807	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.01	Negative
941	Apt # 807	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.01	Negative
942	Apt # 807	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
943	Apt # 807	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.02	Negative
944	Apt # 807	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0.02	Negative
945	Apt # 807	Kitchen/Entry	-	Ceiling		Concrete	Poor	White	0.01	Negative
946	Apt # 807	Kitchen/Entry	A	Door		Wood	Intact	Beige	0	Negative
947	Apt # 807	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.01	Negative
948	Apt # 807	Kitchen/Entry	C	Shelf		Wood	Intact	White	0.02	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
949	Apt # 807	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0.02	Negative
950	Apt # 807	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
951	Apt # 807	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0.02	Negative
952	Apt # 807	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0	Negative
953	Apt # 807	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	Varnish	0.01	Negative
954	Apt # 807	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0.02	Negative
955	Apt # 807	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
956	Apt # 807	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
957	Apt # 807	Bathroom	A	Wall		Concrete	Intact	Beige	0.01	Negative
958	Apt # 807	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
959	Apt # 807	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
960	Apt # 807	Bathroom	D	Wall		Drywall	Intact	Beige	0.03	Negative
961	Apt # 807	Bathroom	-	Ceiling		Concrete	Poor	White	0	Negative
962	Apt # 807	Bathroom	D	Door		Wood	Intact	White	0.07	Negative
963	Apt # 807	Bathroom	D	Door	Casing	Metal	Intact	White	0	Negative
964	Apt # 807	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
965	Apt # 807	Bathroom	B	Vent		Metal	Intact	White	0	Negative
966	Apt # 807	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0	Negative
967	Apt # 807	Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
968	Apt # 807	Bedroom	B	Wall		Drywall	Intact	Beige	0.04	Negative
969	Apt # 807	Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
970	Apt # 807	Bedroom	C	Wall		Drywall	Intact	Beige	0.04	Negative
971	Apt # 807	Bedroom	D	Wall		Drywall	Intact	Beige	0.04	Negative
972	Apt # 807	Bedroom	-	Ceiling		Concrete	Poor	White	0.03	Negative
973	Apt # 807	Bedroom	A	Door		Wood	Intact	White	-0.81	Negative
974	Apt # 807	Bedroom	A	Door	Casing	Metal	Intact	White	0.03	Negative
975	Apt # 807	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0.01	Negative
976	Apt # 807	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0.07	Negative
977	Apt # 807	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.02	Negative
978	Apt # 807	Bedroom	C	Radiator		Metal	Intact	White	0.01	Negative
979	Apt # 807	Bedroom	C	Window	Sill	Wood	Intact	White	0.02	Negative
980	Apt # 807	Bedroom	C	Window	Casing	Wood	Intact	White	0.01	Negative
981	Apt # 807	Bedroom	B	Shelf		Wood	Intact	Varnish	0.07	Negative
982	Apt # 807	Bedroom	B	Shelf	Support	Wood	Intact	White	0	Negative
983	Apt # 807	Living Room	A	Wall		Drywall	Intact	Beige	0.11	Negative
984	Apt # 807	Living Room	B	Wall		Drywall	Intact	Brown	0	Negative
985	Apt # 807	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
986	Apt # 807	Living Room	D	Wall		Drywall	Intact	Beige	0.04	Negative
987	Apt # 807	Living Room	D	Wall		Concrete	Intact	Beige	0	Negative
988	Apt # 807	Living Room	-	Ceiling		Concrete	Poor	White	0	Negative
989	Apt # 807	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
990	Apt # 807	Living Room	C	Radiator		Metal	Intact	White	0	Negative
991	Apt # 807	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
992	Apt # 807	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
993	Apt # 807	Living Room	C	Window	Panel	Metal	Intact	Brown	0.01	Negative
994	Apt # 709	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
995	Apt # 709	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
996	Apt # 709	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
997	Apt # 709	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
998	Apt # 709	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.04	Negative
999	Apt # 709	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
1000	Apt # 709	Kitchen/Entry	-	Ceiling		Concrete	Poor	White	0.05	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1001	Apt # 709	Kitchen/Entry	A	Door		Wood	Intact	Beige	0	Negative
1002	Apt # 709	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.03	Negative
1003	Apt # 709	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0	Negative
1004	Apt # 709	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
1005	Apt # 709	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
1006	Apt # 709	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1007	Apt # 709	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
1008	Apt # 709	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0.02	Negative
1009	Apt # 709	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
1010	Apt # 709	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0.04	Negative
1011	Apt # 709	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
1012	Apt # 709	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
1013	Apt # 709	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
1014	Apt # 709	Living Room	D	Wall		Drywall	Intact	Brown	0	Negative
1015	Apt # 709	Living Room	-	Ceiling		Concrete	Poor	White	0.01	Negative
1016	Apt # 709	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1017	Apt # 709	Living Room	C	Radiator		Metal	Intact	White	0	Negative
1018	Apt # 709	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative
1019	Apt # 709	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
1020	Apt # 709	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
1021	Apt # 709	Bedroom	A	Wall		Drywall	Intact	Beige	0.04	Negative
1022	Apt # 709	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
1023	Apt # 709	Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
1024	Apt # 709	Bedroom	D	Wall		Drywall	Intact	Beige	0.01	Negative
1025	Apt # 709	Bedroom	D	Wall		Concrete	Intact	Beige	0	Negative
1026	Apt # 709	Bedroom	-	Ceiling		Concrete	Poor	White	0.1	Negative
1027	Apt # 709	Bedroom	A	Door		Wood	Intact	White	0	Negative
1028	Apt # 709	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
1029	Apt # 709	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
1030	Apt # 709	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
1031	Apt # 709	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.03	Negative
1032	Apt # 709	Bedroom	C	Radiator		Metal	Intact	White	0	Negative
1033	Apt # 709	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
1034	Apt # 709	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
1035	Apt # 709	Bedroom	D	Shelf		Wood	Intact	Varnish	0.02	Negative
1036	Apt # 709	Bedroom	D	Shelf	Support	Wood	Intact	White	0	Negative
1037	Apt # 709	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
1038	Apt # 709	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
1039	Apt # 709	Bathroom	B	Wall		Drywall	Intact	Beige	0.02	Negative
1040	Apt # 709	Bathroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
1041	Apt # 709	Bathroom	D	Wall		Drywall	Intact	Beige	-0.02	Negative
1042	Apt # 709	Bathroom	-	Ceiling		Concrete	Poor	White	0	Negative
1043	Apt # 709	Bathroom	B	Door		Wood	Intact	White	0.01	Negative
1044	Apt # 709	Bathroom	B	Door	Casing	Metal	Intact	White	0	Negative
1045	Apt # 709	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
1046	Apt # 709	Bathroom	D	Vent		Metal	Intact	White	0	Negative
1047	Apt # 709	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.1	Negative
1048	Apt # 402	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.02	Negative
1049	Apt # 402	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
1050	Apt # 402	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.01	Negative
1051	Apt # 402	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.02	Negative
1052	Apt # 402	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1053	Apt # 402	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
1054	Apt # 402	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
1055	Apt # 402	Kitchen/Entry	A	Door		Wood	Intact	White	0.01	Negative
1056	Apt # 402	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0.03	Negative
1057	Apt # 402	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0	Negative
1058	Apt # 402	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0.01	Negative
1059	Apt # 402	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
1060	Apt # 402	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0	Negative
1061	Apt # 402	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	White	0	Negative
1062	Apt # 402	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0.04	Negative
1063	Apt # 402	Bathroom	A	Wall		Drywall	Intact	Beige	0.01	Negative
1064	Apt # 402	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
1065	Apt # 402	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
1066	Apt # 402	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
1067	Apt # 402	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
1068	Apt # 402	Bathroom	-	Ceiling		Concrete	Intact	White	0	Negative
1069	Apt # 402	Bathroom	D	Door		Wood	Intact	White	0.02	Negative
1070	Apt # 402	Bathroom	D	Door	Casing	Metal	Intact	White	0.03	Negative
1071	Apt # 402	Bathroom	C	Radiator		Metal	Intact	White	0.01	Negative
1072	Apt # 402	Bathroom	B	Vent		Metal	Intact	White	0	Negative
1073	Apt # 402	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0.04	Negative
1074	Apt # 402	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
1075	Apt # 402	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
1076	Apt # 402	Living Room/Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
1077	Apt # 402	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0.02	Negative
1078	Apt # 402	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
1079	Apt # 402	Living Room/Bedroom	-	Ceiling		Concrete	Intact	White	0.27	Negative
1080	Apt # 402	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1081	Apt # 402	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0	Negative
1082	Apt # 402	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
1083	Apt # 402	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
1084	Apt # 402	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0.07	Negative
1085	Apt # 402	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
1086	Apt # 402	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	White	0	Negative
1087	Apt # 402	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
1088	Apt # 410	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.03	Negative
1089	Apt # 410	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
1090	Apt # 410	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
1091	Apt # 410	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1092	Apt # 410	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0.01	Negative
1093	Apt # 410	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
1094	Apt # 410	Kitchen/Entry	-	Ceiling		Concrete	Poor	White	0.03	Negative
1095	Apt # 410	Kitchen/Entry	A	Door		Wood	Intact	White	0	Negative
1096	Apt # 410	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0	Negative
1097	Apt # 410	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0	Negative
1098	Apt # 410	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1099	Apt # 410	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
1100	Apt # 410	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0	Negative
1101	Apt # 410	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	Varnish	0	Negative
1102	Apt # 410	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0	Negative
1103	Apt # 410	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
1104	Apt # 410	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
1105	Apt # 410	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
1106	Apt # 410	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
1107	Apt # 410	Living Room/Bedroom	D	Wall		Concrete	Intact	Beige	0.03	Negative
1108	Apt # 410	Living Room/Bedroom	-	Ceiling		Concrete	Poor	White	0.02	Negative
1109	Apt # 410	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1110	Apt # 410	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0	Negative
1111	Apt # 410	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
1112	Apt # 410	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
1113	Apt # 410	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
1114	Apt # 410	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	White	0	Negative
1115	Apt # 410	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.14	Negative
1116	Apt # 410	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
1117	Apt # 410	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
1118	Apt # 410	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
1119	Apt # 410	Bathroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
1120	Apt # 410	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
1121	Apt # 410	Bathroom	-	Ceiling		Concrete	Poor	White	0	Negative
1122	Apt # 410	Bathroom	B	Door		Wood	Intact	White	0	Negative
1123	Apt # 410	Bathroom	B	Door	Casing	Metal	Intact	White	0.12	Negative
1124	Apt # 410	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
1125	Apt # 410	Bathroom	D	Vent		Metal	Intact	White	0.01	Negative
1126	Apt # 410	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0	Negative
1127	Apt # 308	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.01	Negative
1128	Apt # 308	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0	Negative
1129	Apt # 308	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.01	Negative
1130	Apt # 308	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
1131	Apt # 308	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1132	Apt # 308	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
1133	Apt # 308	Kitchen/Entry	-	Ceiling		Concrete	Intact	White	0	Negative
1134	Apt # 308	Kitchen/Entry	A	Door		Wood	Intact	Beige	0	Negative
1135	Apt # 308	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0.03	Negative
1136	Apt # 308	Kitchen/Entry	B	Electrical Panel Door		Metal	Intact	White	0	Negative
1137	Apt # 308	Kitchen/Entry	C	Shelf		Wood	Intact	White	0	Negative
1138	Apt # 308	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
1139	Apt # 308	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1140	Apt # 308	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0.4	Negative
1141	Apt # 308	Kitchen/Entry	D	Closet	Door	Wood	Intact	Varnish	0	Negative
1142	Apt # 308	Kitchen/Entry	D	Closet	Shelf	Wood	Intact	White	0	Negative
1143	Apt # 308	Kitchen/Entry	D	Closet	Shelf Support	Wood	Intact	White	0	Negative
1144	Apt # 308	Living Room	A	Wall		Drywall	Intact	Beige	0	Negative
1145	Apt # 308	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
1146	Apt # 308	Living Room	B	Wall		Concrete	Intact	Beige	0.01	Negative
1147	Apt # 308	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
1148	Apt # 308	Living Room	D	Wall		Drywall	Intact	Beige	0.03	Negative
1149	Apt # 308	Living Room	-	Ceiling		Concrete	Intact	White	0	Negative
1150	Apt # 308	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1151	Apt # 308	Living Room	C	Radiator		Metal	Intact	White	0	Negative
1152	Apt # 308	Living Room	C	Window	Sill	Wood	Intact	White	0.14	Negative
1153	Apt # 308	Living Room	C	Window	Casing	Wood	Intact	White	-0.36	Negative
1154	Apt # 308	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
1155	Apt # 308	Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
1156	Apt # 308	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
1157	Apt # 308	Bedroom	C	Wall		Drywall	Intact	Beige	0.01	Negative
1158	Apt # 308	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
1159	Apt # 308	Bedroom	D	Wall		Concrete	Intact	Beige	0	Negative
1160	Apt # 308	Bedroom	-	Ceiling		Concrete	Intact	White	0	Negative
1161	Apt # 308	Bedroom	A	Door		Wood	Intact	White	0	Negative
1162	Apt # 308	Bedroom	A	Door	Casing	Metal	Intact	White	0	Negative
1163	Apt # 308	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
1164	Apt # 308	Bedroom	A	Closet	Shelf	Wood	Intact	Varnish	0	Negative
1165	Apt # 308	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
1166	Apt # 308	Bedroom	C	Radiator		Metal	Intact	White	0.04	Negative
1167	Apt # 308	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
1168	Apt # 308	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
1169	Apt # 308	Bedroom	D	Shelf		Wood	Intact	White	0.01	Negative
1170	Apt # 308	Bedroom	D	Shelf	Support	Wood	Intact	White	0	Negative
1171	Apt # 308	Bathroom	A	Wall		Drywall	Intact	Beige	0.02	Negative
1172	Apt # 308	Bathroom	A	Wall		Concrete	Intact	Beige	0	Negative
1173	Apt # 308	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
1174	Apt # 308	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
1175	Apt # 308	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
1176	Apt # 308	Bathroom	-	Ceiling		Concrete	Intact	White	0	Negative
1177	Apt # 308	Bathroom	B	Door		Wood	Intact	White	0.04	Negative
1178	Apt # 308	Bathroom	B	Door	Casing	Metal	Intact	White	0.01	Negative
1179	Apt # 308	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
1180	Apt # 308	Bathroom	D	Vent		Metal	Intact	White	0	Negative
1181	Apt # 308	Bathroom	D	Medicine Cabinet		Metal	Intact	White	0.28	Negative
1182	Apt # 302	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0	Negative
1183	Apt # 302	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.02	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1184	Apt # 302	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0.08	Negative
1185	Apt # 302	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0.01	Negative
1186	Apt # 302	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
1187	Apt # 302	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
1188	Apt # 302	Kitchen/Entry	-	Ceiling		Concrete	Poor	White	0	Negative
1189	Apt # 302	Kitchen/Entry	A	Door		Wood	Intact	White	0	Negative
1190	Apt # 302	Kitchen/Entry	A	Door	Casing	Metal	Intact	White	0	Negative
1191	Apt # 302	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0.11	Negative
1192	Apt # 302	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1193	Apt # 302	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
1194	Apt # 302	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0	Negative
1195	Apt # 302	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	White	0	Negative
1196	Apt # 302	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0	Negative
1197	Apt # 302	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
1198	Apt # 302	Bathroom	A	Wall		Concrete	Intact	Beige	0.23	Negative
1199	Apt # 302	Bathroom	B	Wall		Drywall	Intact	Beige	0	Negative
1200	Apt # 302	Bathroom	C	Wall		Drywall	Poor	Beige	0	Negative
1201	Apt # 302	Bathroom	D	Wall		Drywall	Intact	Beige	0.22	Negative
1202	Apt # 302	Bathroom	-	Ceiling		Concrete	Poor	White	0	Negative
1203	Apt # 302	Bathroom	D	Door		Wood	Intact	White	0	Negative
1204	Apt # 302	Bathroom	D	Door	Casing	Metal	Intact	White	0.19	Negative
1205	Apt # 302	Bathroom	C	Radiator		Metal	Intact	White	0	Negative
1206	Apt # 302	Bathroom	B	Vent		Metal	Intact	White	0	Negative
1207	Apt # 302	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0.04	Negative
1208	Apt # 302	Living Room/Bedroom	A	Wall		Drywall	Intact	Beige	0	Negative
1209	Apt # 302	Living Room/Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
1210	Apt # 302	Living Room/Bedroom	B	Wall		Concrete	Intact	Beige	0.02	Negative
1211	Apt # 302	Living Room/Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
1212	Apt # 302	Living Room/Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
1213	Apt # 302	Living Room/Bedroom	-	Ceiling		Concrete	Poor	White	0	Negative
1214	Apt # 302	Living Room/Bedroom	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1215	Apt # 302	Living Room/Bedroom	C	Radiator		Metal	Intact	White	0	Negative
1216	Apt # 302	Living Room/Bedroom	C	Window	Sill	Wood	Intact	White	0.03	Negative
1217	Apt # 302	Living Room/Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
1218	Apt # 302	Living Room/Bedroom	C	Window	Panel	Metal	Intact	Brown	0	Negative
1219	Apt # 302	Living Room/Bedroom	A	Closet	Door	Wood	Intact	Varnish	0	Negative
1220	Apt # 302	Living Room/Bedroom	A	Closet	Shelf	Wood	Intact	White	0	Negative
1221	Apt # 302	Living Room/Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0.01	Negative
1222	Apt # 209	Kitchen/Entry	A	Wall		Drywall	Intact	Beige	0.07	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1223	Apt # 209	Kitchen/Entry	A	Wall		Brick	Intact	Beige	0.08	Negative
1224	Apt # 209	Kitchen/Entry	A	Wall		Concrete	Intact	Beige	0	Negative
1225	Apt # 209	Kitchen/Entry	B	Wall		Drywall	Intact	Beige	0	Negative
1226	Apt # 209	Kitchen/Entry	C	Wall		Drywall	Intact	Beige	0	Negative
1227	Apt # 209	Kitchen/Entry	D	Wall		Drywall	Intact	Beige	0	Negative
1228	Apt # 209	Kitchen/Entry	-	Ceiling		Concrete	Poor	White	0	Negative
1229	Apt # 209	Kitchen/Entry	A	Door		Wood	Intact	Beige	0.16	Negative
1230	Apt # 209	Kitchen/Entry	A	Door	Casing	Metal	Intact	Beige	0	Negative
1231	Apt # 209	Kitchen/Entry	C	Shelf		Wood	Intact	White	0.15	Negative
1232	Apt # 209	Kitchen/Entry	C	Shelf	Support	Wood	Intact	White	0	Negative
1233	Apt # 209	Kitchen/Entry	C	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1234	Apt # 209	Kitchen/Entry	C	Cabinet	Door	Wood	Intact	Varnish	0	Negative
1235	Apt # 209	Kitchen/Entry	B	Closet	Door	Wood	Intact	Varnish	0.02	Negative
1236	Apt # 209	Kitchen/Entry	B	Closet	Shelf	Wood	Intact	White	0	Negative
1237	Apt # 209	Kitchen/Entry	B	Closet	Shelf Support	Wood	Intact	White	0	Negative
1238	Apt # 209	Kitchen/Entry	D	Electrical Panel Door		Metal	Intact	White	0.01	Negative
1239	Apt # 209	Bathroom	A	Wall		Drywall	Intact	Beige	0	Negative
1240	Apt # 209	Bathroom	A	Wall		Concrete	Intact	Beige	0.01	Negative
1241	Apt # 209	Bathroom	B	Wall		Drywall	Intact	Beige	-0.23	Negative
1242	Apt # 209	Bathroom	C	Wall		Drywall	Intact	Beige	0	Negative
1243	Apt # 209	Bathroom	D	Wall		Drywall	Intact	Beige	0	Negative
1244	Apt # 209	Bathroom	-	Ceiling		Concrete	Poor	White	0	Negative
1245	Apt # 209	Bathroom	D	Door		Wood	Intact	White	0	Negative
1246	Apt # 209	Bathroom	D	Door	Casing	Metal	Intact	White	0	Negative
1247	Apt # 209	Bathroom	C	Radiator		Metal	Intact	White	0.14	Negative
1248	Apt # 209	Bathroom	B	Vent		Metal	Intact	White	0	Negative
1249	Apt # 209	Bathroom	B	Medicine Cabinet		Metal	Intact	White	0	Negative
1250	Apt # 209	Bedroom	A	Wall		Drywall	Intact	Beige	0.06	Negative
1251	Apt # 209	Bedroom	B	Wall		Drywall	Intact	Beige	0	Negative
1252	Apt # 209	Bedroom	B	Wall		Concrete	Intact	Beige	0	Negative
1253	Apt # 209	Bedroom	C	Wall		Drywall	Intact	Beige	0	Negative
1254	Apt # 209	Bedroom	D	Wall		Drywall	Intact	Beige	0	Negative
1255	Apt # 209	Bedroom	-	Ceiling		Concrete	Poor	White	0.01	Negative
1256	Apt # 209	Bedroom	A	Door		Wood	Intact	White	0	Negative
1257	Apt # 209	Bedroom	A	Door	Casing	Metal	Intact	White	0.11	Negative
1258	Apt # 209	Bedroom	A	Closet	Door	Wood	Intact	Varnish	0.01	Negative
1259	Apt # 209	Bedroom	A	Closet	Shelf	Wood	Intact	White	0.03	Negative
1260	Apt # 209	Bedroom	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
1261	Apt # 209	Bedroom	C	Radiator		Metal	Intact	White	0.18	Negative
1262	Apt # 209	Bedroom	C	Window	Sill	Wood	Intact	White	0	Negative
1263	Apt # 209	Bedroom	C	Window	Casing	Wood	Intact	White	0	Negative
1264	Apt # 209	Bedroom	B	Shelf		Wood	Intact	White	0	Negative
1265	Apt # 209	Bedroom	B	Shelf	Support	Wood	Intact	White	0.03	Negative
1266	Apt # 209	Living Room	A	Wall		Drywall	Intact	Beige	0.01	Negative
1267	Apt # 209	Living Room	B	Wall		Drywall	Intact	Beige	0	Negative
1268	Apt # 209	Living Room	C	Wall		Drywall	Intact	Beige	0	Negative
1269	Apt # 209	Living Room	D	Wall		Drywall	Intact	Beige	0.12	Negative
1270	Apt # 209	Living Room	D	Wall		Concrete	Intact	Beige	0	Negative
1271	Apt # 209	Living Room	-	Ceiling		Concrete	Poor	White	0	Negative
1272	Apt # 209	Living Room	A	Cabinet	Base	Wood	Intact	Varnish	0	Negative
1273	Apt # 209	Living Room	C	Radiator		Metal	Intact	White	0.04	Negative
1274	Apt # 209	Living Room	C	Window	Sill	Wood	Intact	White	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1275	Apt # 209	Living Room	C	Window	Casing	Wood	Intact	White	0	Negative
1276	Apt # 209	Living Room	C	Window	Panel	Metal	Intact	Brown	0	Negative
1277	Commons	13th Hallway	A	Wall		Brick	Intact	White	0	Negative
1278	Commons	13th Hallway	A	Wall		Brick	Intact	Green	0.01	Negative
1279	Commons	13th Hallway	B	Wall		Brick	Intact	White	0	Negative
1280	Commons	13th Hallway	B	Wall		Brick	Intact	Green	0	Negative
1281	Commons	13th Hallway	C	Wall		Brick	Intact	White	0.01	Negative
1282	Commons	13th Hallway	C	Wall		Brick	Intact	Green	0.02	Negative
1283	Commons	13th Hallway	D	Wall		Brick	Intact	White	0	Negative
1284	Commons	13th Hallway	D	Wall		Brick	Intact	Green	0	Negative
1285	Commons	13th Hallway	A	Wall		Concrete	Intact	White	0.01	Negative
1286	Commons	13th Hallway	-	Ceiling		Concrete	Intact	White	0	Negative
1287	Commons	13th Hallway	A	Door		Wood	Intact	Beige	0	Negative
1288	Commons	13th Hallway	A	Door	Casing	Metal	Intact	Beige	0	Negative
1289	Commons	13th Hallway	A	Handrail		Wood	Intact	Varnish	-0.01	Negative
1290	Commons	13th Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0	Negative
1291	Commons	13th Hallway	A	Elevator Door		Metal	Intact	Black	0	Negative
1292	Commons	13th Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0	Negative
1293	Commons	13th Hallway	C	Radiator	Base	Wood	Intact	Green	-0.02	Negative
1294	Commons	13th Hallway	D	Electrical Box		Metal	Intact	White	0	Negative
1295	Commons	13th Hallway	D	Vent		Metal	Intact	Beige	0	Negative
1296	Commons	13th Trash Room	A	Wall		Brick	Intact	White	0.01	Negative
1297	Commons	13th Trash Room	B	Wall		Brick	Intact	White	0	Negative
1298	Commons	13th Trash Room	B	Wall		Concrete	Intact	White	0	Negative
1299	Commons	13th Trash Room	C	Wall		Brick	Intact	White	0	Negative
1300	Commons	13th Trash Room	D	Wall		Brick	Intact	White	0	Negative
1301	Commons	13th Trash Room	D	Wall		Brick	Intact	Green	-0.01	Negative
1302	Commons	13th Trash Room	-	Ceiling		Concrete	Intact	White	0	Negative
1303	Commons	13th Trash Room	C	Door		Wood	Intact	Beige	-0.03	Negative
1304	Commons	13th Trash Room	C	Door	Casing	Metal	Intact	Beige	0	Negative
1305	Commons	13th Trash Room	A	Door	Casing	Wood	Intact	White	0	Negative
1306	Commons	12th Hallway	A	Wall		Brick	Intact	White	0	Negative
1307	Commons	12th Hallway	A	Wall		Brick	Intact	Pink	0.03	Negative
1308	Commons	12th Hallway	B	Wall		Brick	Intact	White	0	Negative
1309	Commons	12th Hallway	B	Wall		Brick	Intact	Pink	0	Negative
1310	Commons	12th Hallway	C	Wall		Brick	Intact	White	0.04	Negative
1311	Commons	12th Hallway	C	Wall		Brick	Intact	Pink	0	Negative
1312	Commons	12th Hallway	D	Wall		Brick	Intact	White	0	Negative
1313	Commons	12th Hallway	D	Wall		Brick	Intact	Pink	0	Negative
1314	Commons	12th Hallway	A	Wall		Concrete	Intact	White	0.02	Negative
1315	Commons	12th Hallway	-	Ceiling		Concrete	Intact	White	0	Negative
1316	Commons	12th Hallway	A	Door		Wood	Intact	Beige	0	Negative
1317	Commons	12th Hallway	A	Door	Casing	Metal	Intact	Beige	0	Negative
1318	Commons	12th Hallway	A	Handrail		Wood	Intact	Varnish	0.03	Negative
1319	Commons	12th Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0	Negative
1320	Commons	12th Hallway	A	Elevator Door		Metal	Intact	Black	0	Negative
1321	Commons	12th Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0.04	Negative
1322	Commons	12th Hallway	C	Radiator	Base	Wood	Intact	Green	0	Negative
1323	Commons	12th Hallway	D	Electrical Box		Metal	Intact	White	0	Negative
1324	Commons	12th Hallway	D	Vent		Metal	Intact	Beige	0.06	Negative
1325	Commons	12th Laundry	A	Wall		Brick	Intact	White	0.01	Negative
1326	Commons	12th Laundry	B	Wall		Brick	Intact	White	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1327	Commons	12th Laundry	C	Wall		Brick	Intact	White	0	Negative
1328	Commons	12th Laundry	D	Wall		Brick	Intact	White	0	Negative
1329	Commons	12th Laundry	D	Wall		Brick	Intact	Pink	0.01	Negative
1330	Commons	12th Laundry	D	Wall		Concrete	Intact	White	0	Negative
1331	Commons	12th Laundry	-	Ceiling		Concrete	Intact	White	0	Negative
1332	Commons	12th Laundry	C	Door		Wood	Intact	Beige	0.06	Negative
1333	Commons	12th Laundry	C	Door	Casing	Metal	Intact	Beige	0	Negative
1334	Commons	12th Laundry	D	Closet	Door	Wood	Intact	Beige	0.02	Negative
1335	Commons	12th Laundry	D	Closet	Door Casing	Metal	Intact	Beige	0.01	Negative
1336	Commons	12th Laundry	A	Radiator		Metal	Intact	White	0	Negative
1337	Commons	12th Laundry	A	Window	Sill	Wood	Intact	White	0.03	Negative
1338	Commons	12th Laundry	A	Window	Casing	Wood	Intact	White	0	Negative
1339	Commons	12th Laundry	A	Window	Panel	Metal	Intact	Brown	0	Negative
1340	Commons	12th Laundry	D	Pipe		Metal	Intact	White	0	Negative
1341	Commons	11th Hallway	A	Wall		Brick	Intact	White	0	Negative
1342	Commons	11th Hallway	A	Wall		Brick	Intact	Blue/Green	0.05	Negative
1343	Commons	11th Hallway	B	Wall		Brick	Intact	White	0	Negative
1344	Commons	11th Hallway	B	Wall		Brick	Intact	Blue/Green	0	Negative
1345	Commons	11th Hallway	C	Wall		Brick	Intact	White	0.03	Negative
1346	Commons	11th Hallway	C	Wall		Brick	Intact	Blue/Green	0	Negative
1347	Commons	11th Hallway	D	Wall		Brick	Intact	White	0	Negative
1348	Commons	11th Hallway	D	Wall		Brick	Intact	Blue/Green	0.08	Negative
1349	Commons	11th Hallway	A	Wall		Concrete	Intact	White	0	Negative
1350	Commons	11th Hallway	-	Ceiling		Concrete	Intact	White	0	Negative
1351	Commons	11th Hallway	A	Door		Wood	Intact	Beige	0.02	Negative
1352	Commons	11th Hallway	A	Door	Casing	Metal	Intact	Beige	0	Negative
1353	Commons	11th Hallway	A	Handrail		Wood	Intact	Varnish	0.01	Negative
1354	Commons	11th Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0	Negative
1355	Commons	11th Hallway	A	Elevator Door		Metal	Intact	Black	0	Negative
1356	Commons	11th Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0.03	Negative
1357	Commons	11th Hallway	C	Radiator	Base	Wood	Intact	Blue/Green	0	Negative
1358	Commons	11th Hallway	D	Electrical Box		Metal	Intact	White	0	Negative
1359	Commons	11th Hallway	D	Vent		Metal	Intact	Beige	0.06	Negative
1360	Commons	11th Trash Room	A	Wall		Brick	Intact	White	0	Negative
1361	Commons	11th Trash Room	B	Wall		Brick	Intact	White	0	Negative
1362	Commons	11th Trash Room	B	Wall		Concrete	Intact	White	0.01	Negative
1363	Commons	11th Trash Room	C	Wall		Brick	Intact	White	0	Negative
1364	Commons	11th Trash Room	D	Wall		Brick	Intact	White	0	Negative
1365	Commons	11th Trash Room	D	Wall		Brick	Intact	Blue/Green	0.01	Negative
1366	Commons	11th Trash Room	-	Ceiling		Concrete	Intact	White	0	Negative
1367	Commons	11th Trash Room	C	Door		Wood	Intact	Beige	0.04	Negative
1368	Commons	11th Trash Room	C	Door	Casing	Metal	Intact	Beige	0	Negative
1369	Commons	11th Trash Room	A	Door	Casing	Wood	Intact	Beige	0	Negative
1370	Commons	10th Hallway	A	Wall		Brick	Intact	White	0.05	Negative
1371	Commons	10th Hallway	A	Wall		Brick	Intact	Green	0.01	Negative
1372	Commons	10th Hallway	B	Wall		Brick	Intact	White	0	Negative
1373	Commons	10th Hallway	B	Wall		Brick	Intact	Green	0	Negative
1374	Commons	10th Hallway	C	Wall		Brick	Intact	White	0.03	Negative
1375	Commons	10th Hallway	C	Wall		Brick	Intact	Green	0	Negative
1376	Commons	10th Hallway	D	Wall		Brick	Intact	White	0.07	Negative
1377	Commons	10th Hallway	D	Wall		Brick	Intact	Green	0	Negative
1378	Commons	10th Hallway	A	Wall		Concrete	Intact	White	0	Negative
1379	Commons	10th Hallway	-	Ceiling		Concrete	Intact	White	0.05	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1380	Commons	10th Hallway	A	Door		Wood	Intact	Beige	0	Negative
1381	Commons	10th Hallway	A	Door	Casing	Metal	Intact	Beige	0.01	Negative
1382	Commons	10th Hallway	A	Handrail		Wood	Intact	Varnish	0	Negative
1383	Commons	10th Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0.04	Negative
1384	Commons	10th Hallway	A	Elevator Door		Metal	Intact	Black	0	Negative
1385	Commons	10th Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0	Negative
1386	Commons	10th Hallway	C	Radiator	Base	Wood	Intact	Green	0.04	Negative
1387	Commons	10th Hallway	D	Electrical Box		Metal	Intact	White	0	Negative
1388	Commons	10th Hallway	D	Vent		Metal	Intact	Beige	0	Negative
1389	Commons	9th Hallway	A	Wall		Brick	Intact	White	0.05	Negative
1390	Commons	9th Hallway	A	Wall		Brick	Intact	Pink	0	Negative
1391	Commons	9th Hallway	B	Wall		Brick	Intact	White	0	Negative
1392	Commons	9th Hallway	B	Wall		Brick	Intact	Pink	0.02	Negative
1393	Commons	9th Hallway	C	Wall		Brick	Intact	White	0	Negative
1394	Commons	9th Hallway	C	Wall		Brick	Intact	Pink	0	Negative
1395	Commons	9th Hallway	D	Wall		Brick	Intact	White	0.08	Negative
1396	Commons	9th Hallway	D	Wall		Brick	Intact	Pink	0	Negative
1397	Commons	9th Hallway	A	Wall		Concrete	Intact	White	0	Negative
1398	Commons	9th Hallway	-	Ceiling		Concrete	Intact	White	0.06	Negative
1399	Commons	9th Hallway	A	Door		Wood	Intact	Beige	0.01	Negative
1400	Commons	9th Hallway	A	Door	Casing	Metal	Intact	Beige	0	Negative
1401	Commons	9th Hallway	A	Handrail		Wood	Intact	Varnish	0	Negative
1402	Commons	9th Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0	Negative
1403	Commons	9th Hallway	A	Elevator Door		Metal	Intact	Black	0.1	Negative
1404	Commons	9th Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0	Negative
1405	Commons	9th Hallway	C	Radiator	Base	Wood	Intact	Pink	0	Negative
1406	Commons	9th Hallway	D	Electrical Box		Metal	Intact	White	0.03	Negative
1407	Commons	9th Hallway	D	Vent		Metal	Intact	Beige	0	Negative
1408	Commons	9th Trash Room	A	Wall		Brick	Intact	White	-0.01	Negative
1409	Commons	9th Trash Room	B	Wall		Brick	Intact	White	0	Negative
1410	Commons	9th Trash Room	B	Wall		Concrete	Intact	White	0	Negative
1411	Commons	9th Trash Room	C	Wall		Brick	Intact	White	0.03	Negative
1412	Commons	9th Trash Room	D	Wall		Brick	Intact	White	0.05	Negative
1413	Commons	9th Trash Room	D	Wall		Brick	Intact	Pink	0	Negative
1414	Commons	9th Trash Room	-	Ceiling		Concrete	Intact	White	0	Negative
1415	Commons	9th Trash Room	C	Door		Wood	Intact	Beige	0.04	Negative
1416	Commons	9th Trash Room	C	Door	Casing	Metal	Intact	Beige	0	Negative
1417	Commons	9th Trash Room	A	Door	Casing	Wood	Intact	Beige	0	Negative
1418	Commons	8th Laundry	A	Wall		Brick	Intact	White	0.02	Negative
1419	Commons	8th Laundry	B	Wall		Brick	Intact	White	0	Negative
1420	Commons	8th Laundry	C	Wall		Brick	Intact	White	-0.01	Negative
1421	Commons	8th Laundry	D	Wall		Brick	Intact	White	0	Negative
1422	Commons	8th Laundry	D	Wall		Brick	Intact	Blue/Green	0	Negative
1423	Commons	8th Laundry	D	Wall		Concrete	Intact	White	0	Negative
1424	Commons	8th Laundry	-	Ceiling		Concrete	Intact	White	0.04	Negative
1425	Commons	8th Laundry	C	Door		Wood	Intact	Beige	0	Negative
1426	Commons	8th Laundry	C	Door	Casing	Metal	Intact	Beige	-0.03	Negative
1427	Commons	8th Laundry	D	Closet	Door	Wood	Intact	Beige	0	Negative
1428	Commons	8th Laundry	D	Closet	Door Casing	Metal	Intact	Beige	0.02	Negative
1429	Commons	8th Laundry	A	Radiator		Metal	Intact	White	0.01	Negative
1430	Commons	8th Laundry	A	Window	Sill	Wood	Intact	White	0.1	Negative
1431	Commons	8th Laundry	A	Window	Casing	Wood	Intact	White	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1432	Commons	8th Laundry	A	Window	Panel	Metal	Intact	Brown	0.02	Negative
1433	Commons	8th Laundry	D	Pipe		Metal	Intact	White	0.03	Negative
1434	Commons	7th Hallway	A	Wall		Brick	Intact	White	0	Negative
1435	Commons	7th Hallway	A	Wall		Brick	Intact	Green	0.01	Negative
1436	Commons	7th Hallway	B	Wall		Brick	Intact	White	0	Negative
1437	Commons	7th Hallway	B	Wall		Brick	Intact	Green	0.01	Negative
1438	Commons	7th Hallway	C	Wall		Brick	Intact	White	0.04	Negative
1439	Commons	7th Hallway	C	Wall		Brick	Intact	Green	0	Negative
1440	Commons	7th Hallway	D	Wall		Brick	Intact	White	0.02	Negative
1441	Commons	7th Hallway	D	Wall		Brick	Intact	Green	0	Negative
1442	Commons	7th Hallway	A	Wall		Concrete	Intact	White	0	Negative
1443	Commons	7th Hallway	-	Ceiling		Concrete	Intact	White	-0.04	Negative
1444	Commons	7th Hallway	A	Door		Wood	Intact	Beige	0	Negative
1445	Commons	7th Hallway	A	Door	Casing	Metal	Intact	Beige	0	Negative
1446	Commons	7th Hallway	A	Handrail		Wood	Intact	Varnish	-0.02	Negative
1447	Commons	7th Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0	Negative
1448	Commons	7th Hallway	A	Elevator Door		Metal	Intact	Black	0.01	Negative
1449	Commons	7th Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0.02	Negative
1450	Commons	7th Hallway	C	Radiator	Base	Wood	Intact	Green	-0.09	Negative
1451	Commons	7th Hallway	D	Electrical Box		Metal	Intact	White	0	Negative
1452	Commons	7th Hallway	D	Vent		Metal	Intact	Beige	0	Negative
1453	Commons	7th Trash Room	A	Wall		Brick	Intact	White	0	Negative
1454	Commons	7th Trash Room	B	Wall		Brick	Intact	White	0.03	Negative
1455	Commons	7th Trash Room	B	Wall		Concrete	Intact	White	0	Negative
1456	Commons	7th Trash Room	C	Wall		Brick	Intact	White	0	Negative
1457	Commons	7th Trash Room	D	Wall		Brick	Intact	White	0.02	Negative
1458	Commons	7th Trash Room	D	Wall		Brick	Intact	Green	0.01	Negative
1459	Commons	7th Trash Room	-	Ceiling		Concrete	Intact	White	0	Negative
1460	Commons	7th Trash Room	C	Door		Wood	Intact	Beige	0	Negative
1461	Commons	7th Trash Room	C	Door	Casing	Metal	Intact	Beige	0.1	Negative
1462	Commons	7th Trash Room	A	Door	Casing	Wood	Intact	Beige	0.01	Negative
1463	Commons	5th Hallway	A	Wall		Brick	Intact	White	0.03	Negative
1464	Commons	5th Hallway	A	Wall		Brick	Intact	Blue/Green	0.04	Negative
1465	Commons	5th Hallway	B	Wall		Brick	Intact	White	0	Negative
1466	Commons	5th Hallway	B	Wall		Brick	Intact	Blue/Green	0	Negative
1467	Commons	5th Hallway	C	Wall		Brick	Intact	White	0	Negative
1468	Commons	5th Hallway	C	Wall		Brick	Intact	Blue/Green	0.01	Negative
1469	Commons	5th Hallway	D	Wall		Brick	Intact	White	0	Negative
1470	Commons	5th Hallway	D	Wall		Brick	Intact	Blue/Green	0.04	Negative
1471	Commons	5th Hallway	A	Wall		Concrete	Intact	White	0.02	Negative
1472	Commons	5th Hallway	-	Ceiling		Concrete	Intact	White	0.03	Negative
1473	Commons	5th Hallway	A	Door		Wood	Intact	Beige	0	Negative
1474	Commons	5th Hallway	A	Door	Casing	Metal	Intact	Beige	0	Negative
1475	Commons	5th Hallway	A	Handrail		Wood	Intact	Varnish	0.01	Negative
1476	Commons	5th Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0	Negative
1477	Commons	5th Hallway	A	Elevator Door		Metal	Intact	Black	0	Negative
1478	Commons	5th Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0.02	Negative
1479	Commons	5th Hallway	C	Radiator	Base	Wood	Intact	Blue/Green	0.05	Negative
1480	Commons	5th Hallway	D	Electrical Box		Metal	Intact	White	0	Negative
1481	Commons	5th Hallway	D	Vent		Metal	Intact	Beige	0.04	Negative
1482	Commons	4th Hallway	A	Wall		Brick	Intact	White	0	Negative
1483	Commons	4th Hallway	A	Wall		Brick	Intact	Green	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1484	Commons	4th Hallway	B	Wall		Brick	Intact	White	0.04	Negative
1485	Commons	4th Hallway	B	Wall		Brick	Intact	Green	-0.02	Negative
1486	Commons	4th Hallway	C	Wall		Brick	Intact	White	0.01	Negative
1487	Commons	4th Hallway	C	Wall		Brick	Intact	Green	0	Negative
1488	Commons	4th Hallway	D	Wall		Brick	Intact	White	0.01	Negative
1489	Commons	4th Hallway	D	Wall		Brick	Intact	Green	0.08	Negative
1490	Commons	4th Hallway	A	Wall		Concrete	Intact	White	0	Negative
1491	Commons	4th Hallway	-	Ceiling		Concrete	Intact	White	0.01	Negative
1492	Commons	4th Hallway	A	Door		Wood	Intact	Beige	0	Negative
1493	Commons	4th Hallway	A	Door	Casing	Metal	Intact	Beige	0.03	Negative
1494	Commons	4th Hallway	A	Handrail		Wood	Intact	Varnish	0	Negative
1495	Commons	4th Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0.01	Negative
1496	Commons	4th Hallway	A	Elevator Door		Metal	Intact	Black	0.03	Negative
1497	Commons	4th Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0	Negative
1498	Commons	4th Hallway	C	Radiator	Base	Wood	Intact	Green	0.02	Negative
1499	Commons	4th Hallway	D	Electrical Box		Metal	Intact	White	0.01	Negative
1500	Commons	4th Hallway	D	Vent		Metal	Intact	Beige	0	Negative
1501	Commons	4th Laundry	A	Wall		Brick	Intact	White	0.02	Negative
1502	Commons	4th Laundry	B	Wall		Brick	Intact	White	-0.08	Negative
1503	Commons	4th Laundry	C	Wall		Brick	Intact	White	0	Negative
1504	Commons	4th Laundry	D	Wall		Brick	Intact	White	0.06	Negative
1505	Commons	4th Laundry	D	Wall		Brick	Intact	Blue/Green	0	Negative
1506	Commons	4th Laundry	D	Wall		Concrete	Intact	White	0.03	Negative
1507	Commons	4th Laundry	-	Ceiling		Concrete	Intact	White	0	Negative
1508	Commons	4th Laundry	C	Door		Wood	Intact	Beige	0	Negative
1509	Commons	4th Laundry	C	Door	Casing	Metal	Intact	Beige	0.02	Negative
1510	Commons	4th Laundry	D	Closet	Door	Wood	Intact	Beige	0.01	Negative
1511	Commons	4th Laundry	D	Closet	Door Casing	Metal	Intact	Beige	0.03	Negative
1512	Commons	4th Laundry	A	Radiator		Metal	Intact	White	0	Negative
1513	Commons	4th Laundry	A	Window	Sill	Wood	Intact	White	0.01	Negative
1514	Commons	4th Laundry	A	Window	Casing	Wood	Intact	White	0	Negative
1515	Commons	4th Laundry	A	Window	Panel	Metal	Intact	Brown	0.03	Negative
1516	Commons	4th Laundry	D	Pipe		Metal	Intact	White	0	Negative
1517	Commons	3rd Hallway	A	Wall		Brick	Intact	White	0.02	Negative
1518	Commons	3rd Hallway	A	Wall		Brick	Intact	Pink	0	Negative
1519	Commons	3rd Hallway	B	Wall		Brick	Intact	White	0	Negative
1520	Commons	3rd Hallway	B	Wall		Brick	Intact	Pink	0	Negative
1521	Commons	3rd Hallway	C	Wall		Brick	Intact	White	0	Negative
1522	Commons	3rd Hallway	C	Wall		Brick	Intact	Pink	0	Negative
1523	Commons	3rd Hallway	D	Wall		Brick	Intact	White	0	Negative
1524	Commons	3rd Hallway	D	Wall		Brick	Intact	Pink	0.01	Negative
1525	Commons	3rd Hallway	A	Wall		Concrete	Intact	White	0	Negative
1526	Commons	3rd Hallway	-	Ceiling		Concrete	Intact	White	0	Negative
1527	Commons	3rd Hallway	A	Door		Wood	Intact	Beige	0	Negative
1528	Commons	3rd Hallway	A	Door	Casing	Metal	Intact	Beige	0.04	Negative
1529	Commons	3rd Hallway	A	Handrail		Wood	Intact	Varnish	0	Negative
1530	Commons	3rd Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0	Negative
1531	Commons	3rd Hallway	A	Elevator Door		Metal	Intact	Black	0.1	Negative
1532	Commons	3rd Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0	Negative
1533	Commons	3rd Hallway	C	Radiator	Base	Wood	Intact	Pink	0	Negative
1534	Commons	3rd Hallway	D	Electrical Box		Metal	Intact	White	0.02	Negative
1535	Commons	3rd Hallway	D	Vent		Metal	Intact	Beige	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1536	Commons	3rd Trash Room	A	Wall		Brick	Intact	White	0	Negative
1537	Commons	3rd Trash Room	B	Wall		Brick	Intact	White	-0.04	Negative
1538	Commons	3rd Trash Room	B	Wall		Concrete	Intact	White	0	Negative
1539	Commons	3rd Trash Room	C	Wall		Brick	Intact	White	0	Negative
1540	Commons	3rd Trash Room	D	Wall		Brick	Intact	White	-0.01	Negative
1541	Commons	3rd Trash Room	D	Wall		Brick	Intact	Pink	0	Negative
1542	Commons	3rd Trash Room	-	Ceiling		Concrete	Intact	White	0	Negative
1543	Commons	3rd Trash Room	C	Door		Wood	Intact	Beige	0.1	Negative
1544	Commons	3rd Trash Room	C	Door	Casing	Metal	Intact	Beige	0	Negative
1545	Commons	2nd Hallway	A	Wall		Brick	Intact	White	0	Negative
1546	Commons	2nd Hallway	A	Wall		Brick	Intact	Blue/Green	0	Negative
1547	Commons	2nd Hallway	B	Wall		Brick	Intact	White	-0.21	Negative
1548	Commons	2nd Hallway	B	Wall		Brick	Intact	Blue/Green	0	Negative
1549	Commons	2nd Hallway	C	Wall		Brick	Intact	White	0	Negative
1550	Commons	2nd Hallway	C	Wall		Brick	Intact	Blue/Green	0	Negative
1551	Commons	2nd Hallway	D	Wall		Brick	Intact	White	0.04	Negative
1552	Commons	2nd Hallway	D	Wall		Brick	Intact	Blue/Green	0	Negative
1553	Commons	2nd Hallway	A	Wall		Concrete	Intact	White	0.03	Negative
1554	Commons	2nd Hallway	-	Ceiling		Concrete	Intact	White	0	Negative
1555	Commons	2nd Hallway	A	Door		Wood	Intact	Beige	-0.03	Negative
1556	Commons	2nd Hallway	A	Door	Casing	Metal	Intact	Beige	0	Negative
1557	Commons	2nd Hallway	A	Handrail		Wood	Intact	Varnish	0	Negative
1558	Commons	2nd Hallway	A	Fire Extinguisher Box		Metal	Intact	Red	0	Negative
1559	Commons	2nd Hallway	A	Elevator Door		Metal	Intact	Black	0	Negative
1560	Commons	2nd Hallway	A	Elevator Door	Casing	Metal	Intact	Black	0.02	Negative
1561	Commons	2nd Hallway	C	Radiator	Base	Wood	Intact	Blue/Green	0	Negative
1562	Commons	2nd Hallway	D	Electrical Box		Metal	Intact	White	0	Negative
1563	Commons	2nd Hallway	D	Vent		Metal	Intact	Beige	0	Negative
1564	Commons	1st FI Mens RR	A	Wall		Brick	Intact	Yellow	0	Negative
1565	Commons	1st FI Mens RR	B	Wall		Brick	Intact	Yellow	0.01	Negative
1566	Commons	1st FI Mens RR	C	Wall		Brick	Intact	Yellow	0	Negative
1567	Commons	1st FI Mens RR	D	Wall		Brick	Intact	Yellow	0	Negative
1568	Commons	1st FI Mens RR	A	Door		Wood	Intact	Brown	0	Negative
1569	Commons	1st FI Mens RR	A	Door	Casing	Metal	Intact	Brown	0	Negative
1570	Commons	1st FI Mens RR	A	Window	Casing	Metal	Intact	Brown	-0.04	Negative
1571	Commons	1st FI Mens RR	C	Pipe		Metal	Intact	Yellow	0	Negative
1572	Commons	Pool Room	A	Wall		Brick	Intact	White	0	Negative
1573	Commons	Pool Room	A	Wall		Drywall	Intact	White	0	Negative
1574	Commons	Pool Room	B	Wall		Brick	Intact	White	0.01	Negative
1575	Commons	Pool Room	C	Wall		Drywall	Intact	Blue	0	Negative
1576	Commons	Pool Room	D	Wall		Brick	Intact	White	0.02	Negative
1577	Commons	Pool Room	A	Door		Wood	Intact	Blue	0.03	Negative
1578	Commons	Pool Room	A	Door	Casing	Metal	Intact	Blue	0	Negative
1579	Commons	Pool Room	A	Window	Casing	Metal	Intact	Blue	0	Negative
1580	Commons	Pool Room	A	Closet	Door	Wood	Intact	Blue	0	Negative
1581	Commons	Pool Room	A	Closet	Door Casing	Wood	Intact	Blue	-0.43	Negative
1582	Commons	Pool Room	A	Closet	Shelf	Wood	Intact	White	0	Negative
1583	Commons	Pool Room	A	Closet	Shelf Support	Wood	Intact	White	0	Negative
1584	Commons	Pool Room	C	Window	Sill	Wood	Intact	Blue	-0.01	Negative
1585	Commons	Pool Room	C	Window	Casing	Wood	Intact	Blue	0	Negative
1586	Commons	Pool Room	C	Window	Panel	Metal	Intact	Blue	2.5	Positive
1587	Commons	Pool Room	C	Radiator		Metal	Intact	Blue	0	Negative

Sample #	Unit #	Rm Name	Side	Component	Feature	Substrate	Cond.	Color	Pb/mg cm3	Results
1588	Exterior	Main	A	Wall		Brick	Intact	Brown	0	Negative
1589	Exterior	Main	A	Wall		Concrete	Intact	Beige	0.01	Negative
1590	Exterior	Main	B	Wall		Brick	Intact	Brown	0	Negative
1591	Exterior	Main	B	Wall		Concrete	Intact	Beige	0	Negative
1592	Exterior	Main	C	Wall		Brick	Intact	Brown	0	Negative
1593	Exterior	Main	C	Wall		Concrete	Intact	Beige	0	Negative
1594	Exterior	Main	D	Wall		Brick	Intact	Brown	0	Negative
1595	Exterior	Main	D	Wall		Concrete	Intact	Beige	-0.26	Negative
1596	Exterior	Main	A	Door		Metal	Intact	Brown	0	Negative
1597	Exterior	Main	A	Door	Casing	Metal	Intact	Brown	0.02	Negative
1598	Exterior	Main	A	Door	Panel	Metal	Intact	Brown	2.1	Positive
1599	Exterior	Main	A	Window	Casing	Metal	Intact	Brown	0	Negative
1600	Exterior	Main	A	Window	Panel	Metal	Intact	Brown	2.4	Positive
1601	Exterior	Main	B	Door		Metal	Intact	Brown	0.01	Negative
1602	Exterior	Main	B	Door	Lintel	Metal	Intact	Brown	0	Negative
1603	Exterior	Main	B	Handrail	Post	Metal	Intact	Brown	0	Negative
1604	Exterior	Main	B	Handrail	Railing	Metal	Intact	Brown	0	Negative
1605	Exterior	Main	C	Window	Panel	Metal	Intact	Brown	2.2	Positive
1606	Exterior	Main	D	Door		Metal	Intact	Brown	0	Negative
1607	Exterior	Main	D	Door	Lintel	Metal	Intact	Brown	0	Negative
1608	Exterior	Main	D	Handrail	Post	Metal	Intact	Brown	0	Negative
1609	Exterior	Main	D	Handrail	Railing	Metal	Intact	Brown	0.19	Negative

C-3: PERFORMANCE CHARACTERISTIC SHEETS

An XRF Performance Characteristic Sheet defines acceptable operating specifications and procedures for each model of X-Ray Fluorescence (XRF) lead-based paint analyzer. The make/brand and the model number for each XRF used in this lead-based paint inspection are listed in this report in Appendix C-3, XRF Calibration Documentation. The lead-based paint inspector was required to follow the XRF Performance Characteristic Sheet for the inspection activities described in this report.

The Performance Characteristic Sheet for most XRF models is posted on the U.S. Department of Housing and Urban Development's Office of Healthy Homes and Lead Hazard Control website, specifically, on the web page for the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*. (When this lead evaluation report was written, the web page was www.hud.gov/offices/lead/guidelines/hudguidelines/index.cfm.) HUD has determined that the information provided in the Performance Characteristic Sheets it has posted to its website is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines*.

Readers interested in the operating specifications and procedures for the XRF(s) used can download the Performance Characteristic Sheet(s) from the web page above, or they can obtain the sheet(s) from the National Lead Information Clearinghouse, at 800-424-LEAD (toll-free). Persons with hearing or speech impediments may access the above telephone number via TTY by calling the toll-free Federal Information Relay Service at (800) 877-8339.

APPENDIX D: CERTIFICATIONS, LICENSES, AND ACCREDITATIONS

D-1: Lead-Based Paint Inspector and Risk Assessor's License/Certification Information

D-1: LEAD-BASED PAINT INSPECTOR AND RISK ASSESSOR'S LICENSE/CERTIFICATION INFORMATION

State of Ohio

Department of Health
Lead Program

Lead Risk Assessor



DOB 08/10/1968

Charles R McKee

4731 Backenberry Dr
Friendswood TX 77546

License Number

LA009106

Expiration Date

08/03/2022

Card not valid if altered

This certification is issued pursuant of Chapter 3742 of the Revised Code and 3701-32 of the Ohio Administrative Code

APPENDIX E: LEAD AND LEAD SAFETY RESOURCE DATA

E-1: Glossary

E-2: Resources for Additional Information

E-1: GLOSSARY

Abatement: A measure or set of measures designed to permanently eliminate lead-based paint hazards or lead-based paint. Abatement strategies include the removal of lead-based paint, enclosure, encapsulation, replacement of building components coated with lead-based paint, removal of lead contaminated dust, and removal of lead contaminated soil or overlaying of soil with a durable covering such as asphalt (grass and sod are considered interim control measures). All of these strategies require preparation; cleanup; waste disposal; postabatement clearance testing; recordkeeping; and, if applicable, monitoring. See also [Complete abatement](#) and [Interim controls](#).

Accreditation: A formal recognition certifying that an organization, such as a laboratory, is competent to carry out specific tasks or types of tests.

Accuracy: The degree of agreement between an observed value and an accepted reference value (a “true” value); a data quality indicator. Accuracy includes a combination of random errors (precision) and systematic errors (bias) due to sampling and analysis.

Bare soil: Soil not covered with grass, sod, some other similar vegetation, or paving, including the sand in sandboxes.

Building component: Any element of a building that may be painted or have dust on its surface, e.g., walls, stair treads, floors, railings, doors, windowsills, etc.

Certification: The process of testing and evaluating against certain specifications the competence of a person, organization, or other entity in performing a function or service, usually for a specified period of time.

Certified: The designation for Contractors who have completed training and other requirements to safely allow them to undertake risk assessments, inspections, or abatement work. risk assessors, inspectors, and Abatement Contractors should be certified by the appropriate local, State, or Federal agency.

Chewable surface: See **Chewed surface**.

Chewed surface: Any painted surface that shows evidence of having been chewed or mouthed by a young child. A chewed surface is usually a protruding, horizontal part of a building, such as an interior windowsill.

Cleaning: The process of using a vacuum and wet cleaning agents to remove leaded dust; the process includes the removal of bulk debris from the work area. OSHA prohibits the use of compressed air to clean lead-contaminated dust from a surface.

Clearance examination: Visual examination and collection of environmental samples by an inspector or risk assessor, or, in some circumstances, a Sampling Technician, and analysis by an accredited laboratory upon completion of an abatement project, interim control intervention, or maintenance job that disturbs lead-based paint (or paint suspected of being lead-based). The clearance examination is performed to ensure that lead exposure levels do not exceed standards established by the EPA Administrator pursuant to Title IV of the Toxic Substances Control Act, and that any cleaning following such work adequately meets those standards.

Common area: A room or area that is accessible to all residents in a community (e.g., hallways or lobbies); in general, any area not kept locked.

Composite sample: A single sample made up of individual subsamples. Analysis of a composite sample produces the arithmetic mean of all subsamples.

Containment: A process to protect workers and the environment by controlling exposures to the lead-contaminated dust and debris created during abatement.

Deteriorated lead-based paint: Any lead-based paint coating on a damaged or deteriorated surface or fixture, or any interior or exterior lead-based paint that is peeling, chipping, blistering, flaking, worn, chalking, alligating, cracking, or otherwise becoming separated from the substrate.

Disposal (of waste): The discharge, deposit, injection, dumping, spilling, leaking, or placement of solid or liquid waste on land or in water so that none of its constituents can pollute the environment by being emitted into the air or discharged into a body of water, including groundwater.

Environmental Intervention Blood-Lead Level (EIBL) child: A child who has a blood lead level at or above 20 µg/dL (micrograms of lead per deciliter of blood) in a single test or at 15-19 µg/dL in two tests taken at least 3 months apart.

Encapsulation: Any covering or coating that acts as a barrier between lead-based paint and the environment, the durability of which relies on adhesion and the integrity of the existing bonds between multiple layers of paint and between the paint and the substrate. See also **Enclosure**.

Enclosure: The use of rigid, durable construction materials that are mechanically fastened to the substrate to act as a barrier between the Lead-based paint and the environment.

Evaluation: Risk assessment, paint inspection, reevaluation, investigation, clearance examination, or risk assessment screen.

Examination: See **Clearance examination**.

Federal Register (FR): A daily Federal publication that contains proposed and final regulations, rules, and notices.

Impact surface: An interior or exterior surface (such as surfaces on doors) subject to damage by repeated impact or contact.

Inspection (of paint): A surface-by-surface investigation to determine the presence of lead-based paint (in some cases including dust and soil sampling) and a report of the results.

Interim controls: A set of measures designed to temporarily reduce human exposure or possible exposure to lead-based paint hazards. Such measures include specialized cleaning, repairs, maintenance, painting, temporary containment, and management and resident education programs. Monitoring, conducted by Owners, and reevaluations, conducted by professionals, are integral elements of interim control. Interim controls include dust removal; paint film stabilization; treatment of friction and impact surfaces; installation of soil coverings, such as grass or sod; and land use controls. See also **Monitoring, Reevaluation, and Abatement**.

Interior windowsill: The portion of the horizontal window ledge that protrudes into the interior of the room, adjacent to the window sash when the window is closed; often called the window stool.

Latex: A waterborne emulsion paint made with synthetic binders, such as 100 percent acrylic, vinyl acrylic, terpolymer, or styrene acrylic; a stable emulsion of polymers and pigment in water.

Lead: Lead includes metallic lead and inorganic and organic compounds of lead.

Lead-based paint: Any paint, varnish, shellac, or other coating that contains lead equal to or greater than 1.0 mg/cm² (milligrams of lead per square centimeter of surface) as measured by XRF or laboratory analysis, or 0.5

percent by weight (5,000 µg/g, 5,000 ppm (parts per million), or 5,000 mg/kg) as measured by laboratory analysis. (Local definitions may vary.)

Lead-based paint hazard: A condition in which exposure to lead from lead-contaminated dust, lead-contaminated soil, or deteriorated lead-based paint would have an adverse effect on human health (as established by the EPA Administrator under Title IV of the Toxic Substances Control Act). Lead-based paint hazards include, for example, deteriorated lead-based paint, leaded dust levels above applicable standards, and bare leaded soil above applicable standards.

Lead-based paint hazard control: Activities to control and eliminate lead-based paint hazards, including interim controls, abatement, and complete abatement.

Lead-contaminated dust: Surface dust in residences that contain an area concentration of lead in excess of the standard established by the EPA Administrator, pursuant to Title IV of the Toxic Substances Control Act. EPA standards for leaded dust for risk assessments are 40 µg/ft² (micrograms of lead per square foot) on floors and 250 µg/ft² on interior windowsills. The EPA standards for clearance are 40 µg/ft² on floors, 250 µg/ft² on interior windowsills and 400 µg/ft² on window troughs. The recommended standard for lead hazard screens for floors is 25 µg/ft² and for windowsills is 125 µg/ft².

Lead-contaminated soil: Bare soil on residential property that contains lead in excess of the standard established by the EPA Administrator, pursuant to Title IV of the Toxic Substances Control Act. The standard is 400 µg/g in play areas and 1200 µg/g in the rest of the yard.

Leaded dust: See **Lead-contaminated dust**.

Licensed: Holding a valid license or certification issued by EPA or by an EPA-approved State program pursuant to Title IV of the Toxic Substances Control Act. The license is based on certification for lead-based paint hazard control work. See also **Certified**.

Maintenance: Work intended to maintain adequate living conditions in a dwelling, which has the potential to disturb lead-based paint or paint that is suspected of being lead-based.

Mean: The arithmetic average of a series of numerical data values; for example, the algebraic sum of the data values divided by the number of data values.

Microgram (µg): 1/1,000,000 of a gram; used to measure weight.

Monitoring: Surveillance to determine (1) that known or suspected lead-based paint is not deteriorating; (2) that lead-based paint hazard controls, such as paint stabilization, enclosure, or encapsulation have not failed; and (3) that structural problems do not threaten the integrity of hazard controls or of known or suspected.

Owner: A person, firm, corporation, guardian, conservator, receiver, trustee, executor, government agency or entity, or other judicial officer who, alone or with others, owns, holds, or controls the freehold or leasehold title or part of the title to property, with or without actually possessing it. This definition includes a vendee who possesses the title, but does not include a mortgagee or an Owner of a reversionary interest under a ground rent lease.

Paint inspector: An individual who has completed training from an accredited program and been licensed or certified by the appropriate State or local agency to (1) perform inspections to determine and report the presence of lead-based paint on a surface-by-surface basis through onsite testing, (2) report the findings of such an inspection, (3) collect environmental samples for laboratory analysis, (4) perform clearance testing, and optionally (5) document successful compliance with lead-based paint hazard control requirements or standards.

Paint removal: An abatement strategy that entails the removal of lead-based paint from surfaces. For lead hazard control work, this can mean using chemicals, heat guns below 1,100° F, and certain *contained* abrasive methods. Open-flame burning, open-abrasive blasting, sandblasting, extensive dry scraping, and stripping in a poorly ventilated space using a volatile stripper are prohibited paint removal methods. Hydroblasting is not recommended.

Plastic: See **Polyethylene plastic**.

Polyethylene plastic: All references to polyethylene plastic refer to 6 mil plastic sheeting or polyethylene bags (or doubled bags if using 4 mil polyethylene bags), or any other thick plastic material shown to demonstrate at least equivalent dust containment performance. Plastic used to contain waste should be capable of completely containing the waste and, after being properly sealed, should remain leak tight with no visible signs of discharge during movement or relocation.

Polyurethane: An exceptionally hard and wear-resistant coating (created by the reaction of polyols with a multifunctional isocyanate); often used to seal wood floors following lead-based paint hazard control work and cleaning.

Reevaluation: In lead hazard control work, the combination of a visual assessment and collection of environmental samples performed by a certified risk assessor to determine if a previously implemented lead-based paint hazard control measure is still effective and if the dwelling remains lead-safe.

Removal: See **Paint removal**.

Renovation: Work that involves construction and/or home or building improvement measures such as window replacement, weatherization, remodeling, and repainting.

Replacement: A strategy of abatement that entails the removal of building components coated with lead-based paint (such as windows, doors, and trim) and the installation of new components free of lead-based paint.

Resident: A person who lives in a dwelling.

Risk assessment: An onsite investigation of a residential dwelling to discover any lead-based paint hazards. Risk assessments include an investigation of the age, history, management, and maintenance of the dwelling, and the number of children under age 6 and women of childbearing age who are residents; a visual assessment; limited environmental sampling (i.e., collection of dust wipe samples, soil samples, and deteriorated paint samples); and preparation of a report identifying acceptable abatement and interim control strategies based on specific conditions.

Risk assessor: A certified individual who has completed training with an accredited training program and who has been certified to (1) perform risk assessments, (2) identify acceptable abatement and interim control strategies for reducing identified lead-based paint hazards, (3) perform clearance testing and reevaluations, and (4) document the successful completion of lead-based paint hazard control activities.

Site: The land or body of water where a facility is located or an activity is conducted. The site includes adjacent land used in connection with the facility or activity.

Soil: See **Bare soil**.

Spectrum analyzer: A type of XRF analyzer that provides the operator with a plot of the energy and intensity, or counts of both K and L x-ray spectra, as well as a calculated lead concentration. See also **XRF analyzer**.

Standard deviation: A measure of the precision of a reading; the spread of the deviation from the mean. The smaller the standard deviation, the more precise the analysis. The standard deviation is calculated by first obtaining the mean, or the arithmetic average, of all of the readings. A formula is then used to calculate how much the individual values vary from the mean—the standard deviation is the square root of the arithmetic average of the squares of the deviation from the mean. Many hand calculators have an automatic standard deviation function. See also **Mean**.

Subsample: A representative portion of a sample. A subsample may be either a field sample or a laboratory sample. A subsample is often combined with other subsamples to produce a composite sample. See also **Composite sample**.

Substrate: A surface on which paint, varnish, or other coating has been applied or may be applied. Examples of substrates include wood, plaster, metal, and drywall.

Substrate effect: The radiation returned to an XRF analyzer by the paint, substrate, or underlying material, in addition to the radiation returned by any lead present. This radiation, when counted as lead x-rays by an XRF analyzer contributes to substrate equivalent lead (bias). The inspector may have to compensate for this effect when using XRF analyzers. See also **XRF analyzer**.

Substrate Equivalent Lead (SEL): The XRF measurement taken on an unpainted surface; used to calculate the corrected lead concentration on a surface by using the following formula: Apparent Lead Concentration–Substrate Equivalent Lead = Corrected Lead Concentration. See also **XRF analyzer**.

Target housing: Any residential unit constructed before 1978, except dwellings that do not contain bedrooms or dwellings that were developed specifically for the elderly or persons with disabilities—unless a child younger than 6 resides or is expected to reside in the dwelling. In the case of jurisdictions that banned the sale or use of lead-based paint before 1978, the Secretary of HUD may designate an earlier date for defining target housing.

Test location: A specific area on a testing combination where XRF instruments will test for lead-based paint.

Trained: Successful completion of a training course in a particular discipline. For lead hazard control work, the training course must be accredited by EPA or by an EPA-approved State program, pursuant to Title IV of the Toxic Substances Control Act.

Treatment: In residential lead-based paint hazard control work, any method designed to control lead-based paint hazards. Treatment includes interim controls, abatement, and removal.

Trough: See **Window trough**.

Windowsill: See **Interior windowsill**.

Window trough: For a typical double-hung window, the portion of the exterior windowsill between the interior windowsill (or stool) and the frame of the storm window. If there is no storm window, the window trough is the area that receives both the upper and lower window sashes when they are both lowered. Sometimes inaccurately called the window “well.”

Worker: An individual who has completed training in an accredited program to perform Lead-based paint hazard control in housing.

Worksite: Any interior or exterior area where lead-based paint hazard control work takes place.

XRF analyzer: An instrument that determines lead concentration in milligrams per square centimeter (mg/cm^2) using the principle of x-ray fluorescence (XRF). Two types of field portable XRF analyzers are used — direct readers

and spectrum analyzers. For this lead-based paint inspection, the term XRF analyzer only refers to portable instruments manufactured to analyze paint, that have a HUD Performance Characteristic Sheet, and are interpreted in accordance with the Performance Characteristic Sheet; it does not refer here to laboratory grade units or portable instruments designed to analyze soil.

E-2: RESOURCES FOR ADDITIONAL INFORMATION ON LEAD AND LEAD-BASED PAINT HAZARDS:

HUD OFFICE OF HEALTHY HOMES AND HAZARD CONTROL:

www.hud.gov/offices/lead
202-755-1785, ext. 104
lead_regulations@hud.gov

THE ENVIRONMENTAL PROTECTION AGENCY'S LEAD PROGRAMS:

www.epa.gov/opptintr/lead

NATIONAL LEAD INFORMATION CENTER & CLEARINGHOUSE:

1-800-424 LEAD
www.epa.gov/lead/nlic.htm

NATIONAL CENTER FOR HEALTHY HOUSING:

410-992-0712
www.centerforhealthyhousing.org

LEAD AND ENVIRONMENTAL HAZARD ASSOCIATION

1-800-590-6522
301-924-0265
www.leha.org

THE ALLIANCE FOR HEALTHY HOMES:

202-543-1147
www.afhh.org

ADDITIONAL INFORMATION:

Lists of recalled products containing lead: www.safetyalerts.com

The Lead Listing – for information on lead-related service providers and EPA-accredited laboratories throughout the United States: www.leadlisting.org

February 18, 2021

Lument

10 West Broad Street, 8th Floor
Columbus, Ohio 43215

RE: Asbestos Inspection at:
The Beechwood
330 Forest Avenue
Cincinnati, Ohio 45229
Bureau Veritas Project No.: 147478.20R000-001.086

Dear Sir or Madam:

Bureau Veritas, with the assistance of their subcontractor RiskNomics, LLC, has completed an Asbestos Inspection that included on site observations of the accessible areas of The Beechwood (the "Project"). The inspection was conducted by Christian Matecki, United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) Asbestos Building Inspector and State of Ohio Licensed Asbestos Hazard Evaluation Specialist, on January 19-20, 2021. The inspection consisted of a walk-through and visual observations of the accessible areas for suspect asbestos-containing materials (ACM), assessing the ACM for condition, friability, and quantity, and the collection of bulk samples.

A total of one-hundred ninety-nine (199) bulk samples were analyzed to facilitate the inspection. The following materials were identified to contain asbestos as a result of analysis via polarized light microscopy (PLM):

MATERIAL DESCRIPTION	LOCATION	FRIABLE	APPROX. QUANTITY	% ASBESTOS	CONDITION
9" Gray with White Streaks Floor Tile	Multiple Units Throughout, 9 th & 11 th Floor Storage, Pool Room Closet	No	550 ft ² /unit	3% Chrysotile	Intact
9" Gray with White Streaks Floor Tile Mastic		No		10% Chrysotile	Intact
Black Sink Coating	Unit 1302	No	1 Sink/unit	5% Chrysotile	Intact
Popcorn Ceiling Texture	Throughout Units, Hallways, & Common Areas	Yes	97,500 ft ²	3% Chrysotile	Intact
Drywall Joint Compound	Multiple Units & Common Areas Throughout	Yes	150,000 ft ²	2-3% Chrysotile	Intact
12" Beige with Slight Red/White Blotches Floor Tile Mastic	Multiple Units, 7 th Floor Counselor Office	No	550 ft ² /unit	5% Chrysotile	Intact
12" White with Gray Floor Tile Mastic	Unit 1103	No	550 ft ² /unit	5% Chrysotile	Intact
9" White with Black Streaks Floor Tile Mastic	Multiple Units	No	550 ft ² /unit	5% Chrysotile	Intact
12" White with Gray Floor Tile	Under Carpet Squares in Office	No	475 ft ²	3% Chrysotile	Intact
12" Blue/Gray Floor Tile Mastic	Reception, Reception Lobby, Elevators (2)	No	540 ft ²	2% Chrysotile	Intact
12" Dark/Light Gray Floor Tile Mastic	1 st -13 th Floor Hallways, Trash Rooms, Laundry Rooms, Pool Room, Maintenance Locker Room, & Offices	No	12,500 ft ²	3% Chrysotile	Intact



MATERIAL DESCRIPTION	LOCATION	FRIABLE	APPROX. QUANTITY	% ASBESTOS	CONDITION
12" White with Blue Floor Tile Mastic	Community/Recreation Room	No	460 ft ²	5% Chrysotile	Intact
12" Sky Blue with Blue Floor Tile Mastic	Community/Recreation Room	No	460 ft ²	5% Chrysotile	Intact
Pipe Insulation, Tan	Trash Room	Yes	50 Linear Feet	3% Chrysotile	Intact
Pipe Insulation, Off-White		Yes		85% Chrysotile	Intact
Pipe Insulation Wrap		Yes		2% Chrysotile	Intact
Pipe Elbows	Above Drop Ceiling on 1 st Floor, Maintenance Shop, Assumed in Wall Cavities, Trash Room	Yes	100+ Fittings	2-3% Chrysotile	Intact
Roofing Materials	Roof	No	7,500 ft ²	Assumed	Intact

The remaining materials sampled were found to have no asbestos detected by laboratory analysis via PLM. Please refer to the attached report prepared by RiskNomics, LLC for supporting documentation regarding the inspection including laboratory analysis results and inspector accreditations.

Based on the results of the inspection, Bureau Veritas offers the following recommendations:

- If any ACM will be disturbed as a result of renovation or demolition activities, they should be removed by a State of Ohio certified asbestos abatement contractor prior to disturbance. Any such abatement projects should be monitored by a qualified industrial hygiene firm for worker and environmental safety.
- Any ACM that will not be disturbed should be managed in place using an O&M Program. As part of an O&M Program any contractors bidding on or performing work in the area should be made aware of the presence and locations of ACM.
- Suspected ACM subsequently identified or encountered in non-functional, inaccessible areas during renovation or demolition should be assumed to contain asbestos unless testing confirms otherwise.

The independent conclusions represent our professional judgment based on information and data available to us during the course of this assignment. Factual information regarding operations, conditions, and test data provided by the Client or their representative has been assumed to be correct and complete. The conclusions presented are based on the data provided, observations, and conditions that existed on the date of the on site visit.

If you have any questions regarding this report, please contact me below at (800) 733-0660, Ext. 6454.

Sincerely,



Ron Melchior
 Manager of Expanded Environmental Services
 Bureau Veritas

Attachments: Asbestos Inspection Report prepared by RiskNomics, LLC





ASBESTOS INSPECTION REPORT

Beechwood Apartments

330 Forest Avenue
Cincinnati, Ohio 45229

Inspection Dates: January 19-20, 2021

Prepared for:

Bureau Veritas North America

10461 Mill Run Circle, Suite 1100
Owings Mills, MD 21117

Inspected by:

Christian Matecki

State of Ohio Asbestos Hazard Evaluation Specialist Cert # ES35924
(Expires on 9/13/21)

Project Number: 20RN2260

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EXECUTIVE SUMMARY

On January 19-20, 2021, Mr. Christian Matecki performed an asbestos inspection of Beechwood Apartments, located at 330 Forest Avenue in Cincinnati, Ohio. The objective of the survey was to provide documentation to the Client consisting of a listing of accessible suspect asbestos containing materials located at the facility that may be impacted during upcoming renovation activities. Inspection activities were limited to accessible areas of the building with no destructive investigation of hidden spaces (inside wall cavities, hard deck ceilings, etc.).

Inspection activities were performed by Christian Matecki, a United States (U.S.) Environmental Protection Agency (EPA) Asbestos Hazard Emergency Response Act (AHERA) trained Asbestos Building Inspector, and State of Ohio Licensed Asbestos Hazard Evaluation Specialist. Copies of current Certifications can be found in Appendix B.

Inspection, sampling, material condition assessments, and analytical procedures for asbestos-containing building materials were performed in general accordance with the EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA Title 40, Code of Federal Regulations (CFR), Part 61 Subpart M (40 CFR Part 61, Subpart M), the EPA AHERA regulation (40 CFR Part 763), and the Federal Occupational Safety and Health Administration (OSHA) (29 CFR 1926.1101) guidelines, and the State of Ohio regulations. A total of one-hundred ninety-nine (199) bulk sample materials were analyzed to facilitate the inspection.

Asbestos was identified within the following materials:

Material	Location	Percentage/ Type*	Material Condition	Quantity	NEHSAP Category
9" Gray w/White Streaks Floor Tile	Multiple Units Throughout, 9 th & 11 th Floor Storage, Pool Room Closet	3% Chrysotile	Intact	550 SF/ Unit	CAT I
9" Gray w/White Streaks Floor Tile Mastic		10% Chrysotile	Intact		CAT I
Black Sink Coating	Unit 1302	5% Chrysotile	Intact	1 Sink/ Unit	CAT II
Popcorn Ceiling Texture	Throughout Units, Hallways & Common Areas	3% Chrysotile	Intact	97,500 SF	RACM
Drywall Joint Compound	Multiple Units & Common Areas Throughout	2-3% Chrysotile	Intact	150,000 SF	RACM
12" Beige w/Slight Red/ White Blotches Floor Tile Mastic	Multiple Units, 7 th Floor Counselor Office	5% Chrysotile	Intact	550 SF/ Unit	CAT I
12" White w/Gray Floor Tile Mastic	Unit 1103	5% Chrysotile	Intact	550 SF/ Unit	CAT I
9" White w/Black Streaks Floor Tile Mastic	Multiple Units	5% Chrysotile	Intact	550 SF/ Unit	CAT I
12" White w/Gray Floor Tile	Under Carpet Square in Offices	3% Chrysotile	Intact	475 SF	CAT I

* Laboratory analytical data sheets should be reviewed for potential asbestos content within individual layers of a sample for each material. Analysis of an individual layer of a material may exceed 1% while the composite analysis of the material as a whole is below 1%. Laboratory analytical data sheets are presented within Appendix A.

Material	Location	Percentage/ Type*	Material Condition	Quantity	NEHSAP Category
12" Blue/Gray Floor Tile Mastic	Reception, Reception Lobby, Elevators (2)	2% Chrysotile	Intact	540 SF	CAT I
12" Dark/Light Gray Floor Tile Mastic	1 st – 13 th Floor Hallways, Trash Rooms, Laundry Rooms, Pool Room, Maintenance Locker Room & Offices	3% Chrysotile	Intact	12,500 SF	CAT I
12" White w/Blue Floor Tile Mastic	Community/Recreation Room	5% Chrysotile	Intact	460 SF	CAT I
12" Sky Blue w/Blue Floor Tile Mastic	Community/Recreation Room	5% Chrysotile	Intact	460 SF	CAT I
Pipe Insulation, Tan	Trash Room	3% Chrysotile	Intact	50 LF	RACM
Pipe Insulation, Off-White		85% Chrysotile	Intact		RACM
Pipe Insulation Wrap		2% Chrysotile	Intact		RACM
Pipe Elbows	Above Drop Ceiling on 1 st Floor, Maintenance Shop, Assumed in Wall Cavities, Trash Room	2-3% Chrysotile	Intact	100+	RACM
Roofing Materials	Roof	Assumed	Intact	7,500 SF	CAT II

Asbestos containing material (ACM) as defined by the EPA and OSHA are materials with an asbestos concentration of greater than 1% (>1%) as analyzed by polarized light microscopy (PLM). In addition, ACM is designated as follows for NESHAP compliance:

Friable asbestos – material which can be crumbled, pulverized or reduced to powder by hand pressure, a.k.a. Regulated Asbestos Containing Materials (RACM)

Category I non-friable – includes resilient floor coverings, asphalt roofing products, gaskets and packings.

Category II non-friable – any non-friable ACM that is not in Category I (i.e. transite siding material).

INTRODUCTION

A NESHAP based asbestos survey was completed for Bureau Veritas North America (Client) on January 19-20, 2021 at the Beechwood Apartments located at 330 Forest Avenue in Cincinnati, Ohio by RiskNomics. The inspection included interior and exterior building materials expected to be impacted during upcoming renovation activities. Roofing was not inspected during the inspection.

The buildings and areas inspected included the following:

Beechwood Apartments Units and Areas Inspected
Units: 101, 202, 203, 204, 205, 208, 209, 212, 302, 303, 309, 310, 312, 401, 403, 406, 407, 408, 409, 412, 501, 505, 506, 508, 509, 513, 606, 609, 610, 611, 612, 613, 703, 704, 705, 707, 709, 713, 806, 807, 809, 810, 812, 813, 901, 903, 904, 905, 906, 913, 1001, 1005, 1006, 1008, 1010, 1011, 1013, 1103, 1104, 1105, 1106, 1112, 1201, 1206, 1207, 1208, 1209, 1301, 1302, 1304, 1305, 1306, 1311, 1312 Other Areas: Hallways, Offices, Trash Rooms, Elevators, Pool Room, Community/Recreation Room, Public Restrooms, Laundry Rooms, Storage Rooms, Stairwells, and Mechanical Rooms

Inspection activities were performed by Christian Matecki, a USEPA AHERA trained Asbestos Building Inspector, and State of Ohio licensed Asbestos Hazard Evaluation Specialist. Copies of current Certifications can be found in Appendix B.

SUSPECT ASBESTOS CONTAINING MATERIALS

The following suspect asbestos containing materials were identified and found Negative for Asbestos:

Beechwood Apartments 330 Forest Avenue, Cincinnati, OH			
Sample #	Material	Friable/ Non- Friable	Condition
01 – 03	Drywall & Joint Compound (Joint Compound POS samples 29-31 & 35-37)	NF	Intact
07 – 09	4" Brown Cove Base & Adhesive	NF	Intact
10 – 12	Ceramic Tile, Grout & Mastic	NF	Intact
23 – 25	White Sink Coating	NF	Intact
26 – 28	Fiberglass Pipe Insulation	NF	Intact
29 – 31	4" Black Cove Base & Adhesive (Drywall Joint Compound POS)	NF	Intact
32 – 34	12" Beige w/Red/White Streaks Floor Tile & 2 nd Layer Mastic	NF	Intact
35 – 37	4" Beige Cove Base & Adhesive (Drywall Joint Compound POS)	NF	Intact
38 – 40	12" Beige w/Slight Red/White Blotches Floor Tile (Mastic POS)	NF	Intact
41 – 43	Fiberglass Pipe Insulation	NF	Intact
44 – 46	12" White w/Gray Floor Tile (Mastic POS)	NF	Intact
47 – 49	9" White w/Black Streaks Floor Tile (Mastic POS)	NF	Intact
50 – 52	2' x 2' White Fissure Lines w/Pinholes Ceiling Tile	F	Intact
56 – 58	Carpet Square Mastic	NF	Intact

Beechwood Apartments 330 Forest Avenue, Cincinnati, OH			
Sample #	Material	Friable/ Non-Friable	Condition
59 – 61	12" White w/Gray Floor Tile (Mastic POS)	NF	Intact
62 – 64	12" Blue/Gray Floor Tile (Mastic POS)	NF	Intact
65 – 67	4" Gray Cove Base & Adhesive	NF	Intact
68 – 70	12" Dark/Light Gray Floor Tile (Mastic POS)	NF	Intact
71 – 73	CMU Block & Mortar	NF	Intact
74 – 76	Concrete	NF	Intact
77 – 79	12" White w/Blue Floor Tile (Mastic POS)	NF	Intact
80 – 82	12" Sky Blue w/Blue Floor Tile (Mastic POS)	NF	Intact
83 – 85	2' x 2' White Gouge w/Pinholes Ceiling Tile	F	Intact
86 – 87	12" Brown Floor Tile & Mastic	NF	Intact
88 – 89	12" Yellow Floor Tile & Mastic	NF	Intact
90 – 91	12" Blue w/Dark Blue Floor Tile & Mastic	NF	Intact
92 – 94	4" Pipe Elbows (Other TSI Fittings POS, Treat all as POS)	NF	Intact
95 – 97	8" Pipe Wrap (Other TSI POS, Treat all as POS)	NF	Intact
98 – 100	8" Pipe Elbows (Other TSI Fittings POS, Treat all as POS)	NF	Intact
113 – 115	Brick & Mortar	NF	Intact
116 – 118	Brown Caulk	NF	Intact
119 – 121	Beige Caulk	NF	Intact

SUSPECT ASBESTOS CONTAINING MATERIALS – ASSUMED ASBESTOS

The following suspect asbestos containing materials were identified but not sampled to maintain the materials' integrity and aesthetics, or were inaccessible due to tenant occupancy at the time of the inspection (assumed asbestos containing materials):

Beechwood Apartments Assumed Materials		
Material	Friable/ Non-Friable	Condition
Roofing Materials	NF	Intact

ASBESTOS SAMPLING AND ANALYTICAL PROCEDURES

Sampling Procedures

Representative bulk samples of suspect asbestos containing building materials were randomly collected from the interior and exterior of the building. Homogenous material determination was based on the following criteria:

Similar physical characteristics (same color and texture, etc.)
Application (sprayed-on, troweled-on, assembly into a system etc.)
Material function (Thermal insulation, floor tile, wallboard system etc.)

The bulk samples were collected on the inspection date(s). Condition assessments were performed by the accredited inspectors during the inspection.

PLM Analysis Methodology

Laboratory services were provided by EMC Labs, Inc., located in Phoenix, AZ, a National Voluntary Laboratory Accreditation Program (NVLAP) certified laboratory (NVLAP code #101926-0).

PLM samples were analyzed utilizing the Environmental Protection Agency's Test Methods: Methods for the determination of Asbestos in Bulk Building Materials (EPA 600/R-93/116, July 1993) and the McCrone Research Institute's The Asbestos Particle Atlas as method references. Additional treatment and tests may be required to accurately define composition (i.e. ashing, extraction, acetone treatment, and TEM).

Analysis was performed by using the bulk sample for visual observation and slide preparation(s) for microscopic examination and identification. The samples analyzed for asbestos (chrysotile, amosite, crocidolite, anthophyllite, and actinolite/ tremolite), fibrous non-asbestos constituents (mineral wool, cellulose, etc.) and non-fibrous constituents. Using a stereoscope, the microscopist visually estimated relative amounts of each constituent by determining the volume of each constituent in proportion to the total volume of the sample.

FINDINGS

Interpretation of Asbestos Results

Federal OSHA and EPA define an ACM as any material containing >1% asbestos. The lower limit of reliable detection for asbestos using the PLM analytical method is 1.0% by volume. If "<1%" appears in this report, it should be interpreted as meaning that asbestos was present in the sample, but the exact percentage is unknown.

Furthermore, per EPA NESHAP regulations, friable material with PLM-derived asbestos concentration of <10% must be assumed to be ACM until it is point counted to more precisely determine the actual asbestos content. If this material is found to contain less than 1% asbestos by point counting, then it may be disposed of as non-hazardous waste. Any sample can be subjected to the more stringent Point Count Method of analysis to more precisely determine the actual asbestos content.

Although a material may contain asbestos at <1%, it **DOES NOT** relieve contractors from performing exposure assessments (personal air monitoring) on their employees per the OSHA Asbestos Standard (29 CFR 1926.1101) and should not be interpreted as asbestos is not present.

Although a reading may indicate “<1%”, airborne asbestos concentrations still may exceed the OSHA Permissible Exposure Limit (PEL) depending on the work activity.

The following materials contain Asbestos in concentrations exceeding 1%

- 9” Gray w/White Streaks Floor Tile & Mastic
- Black Sink Coating
- Popcorn Ceiling Texture
- Drywall Joint Compound
- 12” Beige w/Slight Red/White Blotches Floor Tile Mastic
- 12” White w/Gray Floor Tile Mastic
- 9” White w/Black Streaks Floor Tile Mastic
- TSI Pipe Fittings – Various Sizes
- 12” White w/Gray Floor Tile Mastic
- 12” Blue/Gray Floor Tile Mastic
- 12” Dark/Light Gray Floor Tile Mastic
- 12” White w/Blue Floor Tile Mastic
- 12” Sky Blue w/Blue Floor Tile Mastic
- TSI Pipe Insulation- Various Sizes
- Roofing Materials - Assumed

CONCLUSIONS AND RECOMMENDATIONS

Results of analysis confirmed asbestos was identified in concentrations greater than 1% within some of the bulk samples collected. The identified asbestos-containing materials were found to be in good condition at the time of this inspection. Materials uncovered during renovation or demolition activities that are not addressed in this inspection report must be sampled by an accredited asbestos inspector prior to any disturbance.

Regulations require notifications prior to the removal of asbestos-containing materials. If the quantity of the asbestos to be removed is greater than or equal to 160 square/260 linear feet, the contractor shall submit an asbestos notification at least ten working days before asbestos removal begins. An EPA AHERA trained supervisor (state certified where applicable) shall be onsite during all asbestos removal activities and all persons handling asbestos shall be workers or supervisors certified by the EPA (state certified where applicable). Removal shall be performed following all applicable local and federal regulations.

The U.S. Environmental Protection Agency (USEPA) regulations do not require removal of asbestos-containing materials that are in good condition. However, personnel who may be involved with building renovations will need to be advised of the presence of asbestos and appropriate measures may be warranted in order to assure the identified asbestos-containing materials are not disturbed during renovation activities. If the asbestos-containing materials left

in place are disturbed during renovation activities, the materials must be handled and disposed of in accordance with applicable State and Federal regulations.



Andrew J Olcott
President, Operations

DISCLAIMER

The content presented in this report is based on data collected during the site inspection and survey, review of pertinent regulations, requirements, guidelines and commonly followed industry standards, and information provided by the Client, their clients, agents, and representatives.

In occupied facilities and areas, destructive investigation may not have been performed in order to protect the materials aesthetics while the facility was in operation. This may include, but not be limited to: penetration into walls and hard lid ceilings; and investigation that may irreparably damage mirrors and similar components.

The work has been conducted in an objective and unbiased manner and in accordance with generally accepted professional practice for this type of work. RiskNomics believes the data and analysis to be accurate and relevant, but cannot accept responsibility for the accuracy or completeness of available documentation or possible withholding of information of other parties.

This hazardous materials survey report is designed to aid the property owner, architect, construction manager, general contractor, and asbestos abatement contractor in locating ACM. This report is not intended for, and may not be utilized, as a bidding document or as an abatement project specification document.

Table Summarizing Sample Results

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
1	T.O. 1311, 610, OFF BRK RM CL	1	LAYER 1 Drywall, White/ Brown	None Detected	
1	T.O. 1311, 610, OFF BRK RM CL	2	LAYER 2 Joint Compound, White	None Detected	
1	T.O. 1311, 610, OFF BRK RM CL	3	LAYER 3 Tape, Off White	None Detected	
1	T.O. 1311, 610, OFF BRK RM CL	4	LAYER 4 Texture, White/ Off White	None Detected	
2	T.O. 1311, 610, OFF BRK RM CL	1	LAYER 1 Drywall, White/ Brown	None Detected	
2	T.O. 1311, 610, OFF BRK RM CL	2	LAYER 2 Joint Compound, White	None Detected	
2	T.O. 1311, 610, OFF BRK RM CL	3	LAYER 3 Tape, Off White	None Detected	
2	T.O. 1311, 610, OFF BRK RM CL	4	LAYER 4 Texture, White/ Off White	None Detected	
3	T.O. 1311, 610, OFF BRK RM CL	1	LAYER 1 Drywall, White/ Brown	None Detected	
3	T.O. 1311, 610, OFF BRK RM CL	2	LAYER 2 Joint Compound, White	None Detected	
3	T.O. 1311, 610, OFF BRK RM CL	3	LAYER 3 Tape, Off White	None Detected	
3	T.O. 1311, 610, OFF BRK RM CL	4	LAYER 4 Texture, White/ Yellow	None Detected	
4	T.O.	1	LAYER 1 9" Vinyl Floor Tile, Gray/ White/ Streaks	Chrysotile	3%
4	T.O.	2	LAYER 2 Mastic, Black	Chrysotile	10%
5	T.O.	1	LAYER 1 9" Vinyl Floor Tile, Gray/ White/ Streaks Note: *Not analyzed per client request		
5	T.O.	2	LAYER 2 Mastic, Black Note: *Not analyzed per client request		
6	T.O.	1	LAYER 1 9" Vinyl Floor Tile, Gray/ White/ Streaks Note: *Not analyzed per client request		
6	T.O.	2	LAYER 2 Mastic, Black Note: *Not analyzed per client request		
7	T.O.11TH FL STOR, POOL RM	1	LAYER 1 4" Cove Base, Brown	None Detected	

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
7	T.O.11TH FL STOR, POOL RM	2	LAYER 2 Adhesive, Brown	None Detected	
8	T.O.11TH FL STOR, POOL RM	1	LAYER 1 4" Cove Base, Brown	None Detected	
8	T.O.11TH FL STOR, POOL RM	2	LAYER 2 Adhesive, Brown	None Detected	
9	T.O.11TH FL STOR, POOL RM	1	LAYER 1 4" Cove Base, Brown	None Detected	
9	T.O.11TH FL STOR, POOL RM	2	LAYER 2 Adhesive, Brown	None Detected	
10	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	1	LAYER 1 Ceramic Tile, White	None Detected	
10	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	2	LAYER 2 Grout, Off White	None Detected	
10	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	3	LAYER 3 Adhesive, Yellow	None Detected	
11	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	1	LAYER 1 Ceramic Tile, White	None Detected	
11	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	2	LAYER 2 Grout, Off White	None Detected	
11	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	3	LAYER 3 Adhesive, Yellow	None Detected	
12	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	1	LAYER 1 Ceramic Tile, White	None Detected	
12	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	2	LAYER 2 Grout, Off White	None Detected	
12	(SHOWER)...1302, 1304, 1301, 1305, 1312, 1209, 1208, 1201, 1105, 1112, 1010, 1008, 1005..	3	LAYER 3 Adhesive, Yellow	None Detected	
13	(KITCHEN)1302	1	Sink Coating, Black	Chrysotile	5%
14	(KITCHEN)1302	1	Sink Coating, Black Note: *Not analyzed per client request		

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
15	(KITCHEN)1302	1	Sink Coating, Black Note: *Not analyzed per client request		
16	T.O.	1	Popcorn Ceiling Texture, White/ Off White	None Detected	
17	T.O.	1	Popcorn Ceiling Texture, White/ Beige	None Detected	
18	T.O.	1	Popcorn Ceiling Texture, White/ Beige	Chrysotile	3%
19	T.O.	1	Popcorn Ceiling Texture, White/ Beige Note: *Not analyzed per client request		
20	T.O.	1	Popcorn Ceiling Texture, White/ Beige Note: *Not analyzed per client request		
21	T.O.	1	Popcorn Ceiling Texture, White/ Beige Note: *Not analyzed per client request		
22	T.O.	1	Popcorn Ceiling Texture, White/ Beige Note: *Not analyzed per client request		
23	1304, 1301, 1305, 1201, 1006, 806, 501, 409, 408, 407, 406, 401, 285, 101, OFF BRK RM	1	Sink Caulking, White	None Detected	
24	1304, 1301, 1305, 1201, 1006, 806, 501, 409, 408, 407, 406, 401, 285, 101, OFF BRK RM	1	Sink Caulking, White	None Detected	
25	1304, 1301, 1305, 1201, 1006, 806, 501, 409, 408, 407, 406, 401, 285, 101, OFF BRK RM	1	Sink Caulking, White	None Detected	
26	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	1	LAYER 1 Fiberglass, Yellow	None Detected	
26	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	2	LAYER 2 Pipe Wrap, Off White/ Lt. Beige	None Detected	
27	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	1	LAYER 1 Fiberglass, Yellow	None Detected	
27	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	2	LAYER 2 Pipe Wrap, Off White/ Lt. Beige	None Detected	
28	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	1	LAYER 1 Fiberglass, Yellow	None Detected	
28	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	2	LAYER 2 Pipe Wrap, Off White/ Lt. Beige	None Detected	
29	1312....202, 1ST FL, REC. RM	1	LAYER 1 4" Cove Base, Black	None Detected	

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
29	1312....202, 1ST FL, REC. RM	2	LAYER 2 Adhesive, Cream	None Detected	
29	1312....202, 1ST FL, REC. RM	3	LAYER 3 Adhesive, Brown	None Detected	
29	1312....202, 1ST FL, REC. RM	4	LAYER 4 Compound, Beige	Chrysotile	3%
30	1312....202, 1ST FL, REC. RM	1	LAYER 1 4" Cove Base, Black	None Detected	
30	1312....202, 1ST FL, REC. RM	2	LAYER 2 Adhesive, Cream	None Detected	
30	1312....202, 1ST FL, REC. RM	3	LAYER 3 Adhesive, Brown	None Detected	
30	1312....202, 1ST FL, REC. RM	4	LAYER 4 Compound, Beige Note: *Not analyzed per client request		
31	1312....202, 1ST FL, REC. RM	1	LAYER 1 4" Cove Base, Black	None Detected	
31	1312....202, 1ST FL, REC. RM	2	LAYER 2 Adhesive, Cream	None Detected	
31	1312....202, 1ST FL, REC. RM	3	LAYER 3 Adhesive, Brown	None Detected	
31	1312....202, 1ST FL, REC. RM	4	LAYER 4 Compound, Beige Note: *Not analyzed per client request		
32	1311, 1201, 903, 501	1	LAYER 1 12" Vinyl Floor Tile, Beige w/ Red/ White Streaks	None Detected	
32	1311, 1201, 903, 501	2	LAYER 2 Mastic, Yellow	None Detected	
32	1311, 1201, 903, 501	3	LAYER 3 Mastic - Top, Yellow	None Detected	
33	1311, 1201, 903, 501	1	LAYER 1 12" Vinyl Floor Tile, Beige w/ Red/ White Streaks	None Detected	
33	1311, 1201, 903, 501	2	LAYER 2 Mastic, Yellow	None Detected	
33	1311, 1201, 903, 501	3	LAYER 3 Mastic - Top, Yellow	None Detected	
34	1311, 1201, 903, 501	1	LAYER 1 12" Vinyl Floor Tile, Beige w/ Red/ White Streaks	None Detected	
34	1311, 1201, 903, 501	2	LAYER 2 Mastic, Yellow	None Detected	
34	1311, 1201, 903, 501	3	LAYER 3 Mastic - Top, Yellow	None Detected	
35	1207, 1010, 810, 709, 302, 310, 209, 101, 1ST-13TH FL HALLWAYS, POOL RM, MAINT RM.	1	LAYER 1 4" Cove Base, Beige	None Detected	

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
35	1207, 1010, 810, 709, 302, 310, 209, 101, 1ST-13TH FL HALLWAYS, POOL RM, MAINT RM.	2	LAYER 2 Adhesive, Cream	None Detected	
35	1207, 1010, 810, 709, 302, 310, 209, 101, 1ST-13TH FL HALLWAYS, POOL RM, MAINT RM.	3	LAYER 3 Compound, White	Chrysotile	2%
36	1207, 1010, 810, 709, 302, 310, 209, 101, 1ST-13TH FL HALLWAYS, POOL RM, MAINT RM.	1	LAYER 1 4" Cove Base, Beige	None Detected	
36	1207, 1010, 810, 709, 302, 310, 209, 101, 1ST-13TH FL HALLWAYS, POOL RM, MAINT RM.	2	LAYER 2 Adhesive, Cream	None Detected	
37	1207, 1010, 810, 709, 302, 310, 209, 101, 1ST-13TH FL HALLWAYS, POOL RM, MAINT RM.	1	LAYER 1 4" Cove Base, Beige	None Detected	
37	1207, 1010, 810, 709, 302, 310, 209, 101, 1ST-13TH FL HALLWAYS, POOL RM, MAINT RM.	2	LAYER 2 Adhesive, Cream	None Detected	
37	1207, 1010, 810, 709, 302, 310, 209, 101, 1ST-13TH FL HALLWAYS, POOL RM, MAINT RM.	3	LAYER 3 Adhesive, Brown	None Detected	
38	1206, 1201, 1006, 1013, 810, 7TH FL COUNSELOR OFF, 713, 707, 709, 611, 505, 508, 202	1	LAYER 1 12" Vinyl Floor Tile, Beige w/ Lt.Red White Blotches	None Detected	
38	1206, 1201, 1006, 1013, 810, 7TH FL COUNSELOR OFF, 713, 707, 709, 611, 505, 508, 202	2	LAYER 2 Mastic, Brown/ Black	Chrysotile	5%
39	1206, 1201, 1006, 1013, 810, 7TH FL COUNSELOR OFF, 713, 707, 709, 611, 505, 508, 202	1	LAYER 1 12" Vinyl Floor Tile, Beige w/ Lt.Red White Blotches	None Detected	
39	1206, 1201, 1006, 1013, 810, 7TH FL COUNSELOR OFF, 713, 707, 709, 611, 505, 508, 202	2	LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request		
40	1206, 1201, 1006, 1013, 810, 7TH FL COUNSELOR OFF, 713, 707, 709, 611, 505, 508, 202	1	LAYER 1 12" Vinyl Floor Tile, Beige w/ Lt.Red White Blotches	None Detected	
40	1206, 1201, 1006, 1013, 810, 7TH FL COUNSELOR OFF, 713, 707, 709, 611, 505, 508, 202	2	LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request		

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
41	LAUNDRY 12TH FL, END OF HALLWAYS	1	LAYER 1 4" Fiberglass, Yellow	None Detected	
41	LAUNDRY 12TH FL, END OF HALLWAYS	2	LAYER 2 4" Pipe Wrap, White/ Off White	None Detected	
42	LAUNDRY 12TH FL, END OF HALLWAYS	1	LAYER 1 4" Fiberglass, Yellow	None Detected	
42	LAUNDRY 12TH FL, END OF HALLWAYS	2	LAYER 2 4" Pipe Wrap, White/ Off White	None Detected	
43	LAUNDRY 12TH FL, END OF HALLWAYS	1	LAYER 1 4" Fiberglass, Yellow	None Detected	
43	LAUNDRY 12TH FL, END OF HALLWAYS	2	LAYER 2 4" Pipe Wrap, White/ Off White	None Detected	
44	1103	1	LAYER 1 12" Floor Tile, White w/ Gray	None Detected	
44	1103	2	LAYER 2 Mastic, Brown/ Black	Chrysotile	5%
45	1103	1	LAYER 1 12" Floor Tile, White w/ Gray	None Detected	
45	1103	2	LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request		
46	1103	1	LAYER 1 12" Floor Tile, White w/ Gray	None Detected	
46	1103	2	LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request		
47	1010-RR, 1011-PATCH, 913-RR, 610-PATCH, 401-RR, 403-PATCH, 309-BED, 209	1	LAYER 1 9" Vinyl Floor Tile, White w/ Black Streaks	None Detected	
47	1010-RR, 1011-PATCH, 913-RR, 610-PATCH, 401-RR, 403-PATCH, 309-BED, 209	2	LAYER 2 Mastic, Brown/ Black	Chrysotile	5%
48	1010-RR, 1011-PATCH, 913-RR, 610-PATCH, 401-RR, 403-PATCH, 309-BED, 209	1	LAYER 1 9" Vinyl Floor Tile, White w/ Black Streaks	None Detected	
48	1010-RR, 1011-PATCH, 913-RR, 610-PATCH, 401-RR, 403-PATCH, 309-BED, 209	2	LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request		
49	1010-RR, 1011-PATCH, 913-RR, 610-PATCH, 401-RR, 403-PATCH, 309-BED, 209	1	LAYER 1 9" Vinyl Floor Tile, White w/ Black Streaks	None Detected	
49	1010-RR, 1011-PATCH, 913-RR, 610-PATCH, 401-RR, 403-PATCH, 309-BED, 209	2	LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request		
50	101-PUBLIC RR'S (2), COMM/REC RM, POOL RM, MAINT. LOCKER RM & OFFICES	1	2x2 Ceiling Tile Pinhole & Fissure, White/ Beige	None Detected	

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
51	101-PUBLIC RR'S (2), COMM/REC RM, POOL RM, MAINT. LOCKER RM & OFFICES	1	2x2 Ceiling Tile Pinhole & Fissure, White/ Beige	None Detected	
52	101-PUBLIC RR'S (2), COMM/REC RM, POOL RM, MAINT. LOCKER RM & OFFICES	1	2x2 Ceiling Tile Pinhole & Fissure, White/ Beige	None Detected	
53	ABOVE DROP CEILING, 1ST FL. MAINT SHOP	1	2" Pipe Elbow, Gray	Chrysotile	3%
54	ABOVE DROP CEILING, 1ST FL. MAINT SHOP	1	2" Pipe Elbow, Gray Note: *Not analyzed per client request		
55	ABOVE DROP CEILING, 1ST FL. MAINT SHOP	1	2" Pipe Elbow, Gray Note: *Not analyzed per client request		
56	OFFICES (3)	1	Carpet Square Mastic, Green	None Detected	
57	OFFICES (3)	1	Carpet Square Mastic, Green	None Detected	
58	OFFICES (3)	1	Carpet Square Mastic, Green	None Detected	
59	UNDER CARPET SQ	1	LAYER 1 12" Floor Tile, White w/ Gray	None Detected	
59	UNDER CARPET SQ	2	LAYER 2 Mastic, Yellow/ Black	Chrysotile	3%
59	UNDER CARPET SQ	3	LAYER 3 Carpet Mastic, Green	None Detected	
60	UNDER CARPET SQ	1	LAYER 1 12" Floor Tile, White w/ Gray	None Detected	
60	UNDER CARPET SQ	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
60	UNDER CARPET SQ	3	LAYER 3 Carpet Mastic, Green	None Detected	
61	UNDER CARPET SQ	1	LAYER 1 12" Floor Tile, White w/ Gray	None Detected	
61	UNDER CARPET SQ	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
61	UNDER CARPET SQ	3	LAYER 3 Carpet Mastic, Green	None Detected	
62	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	1	LAYER 1 12" Floor Tile, Blue/ Gray	None Detected	
62	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	2	LAYER 2 Mastic, Yellow/ Black Note: Very small amount of black mastic	Chrysotile	2%
63	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	1	LAYER 1 12" Floor Tile, Blue/ Gray	None Detected	
63	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	2	LAYER 2 Mastic, Yellow/ Black		

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
			Note: *Not analyzed per client request		
64	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	1	LAYER 1 12" Floor Tile, Blue/ Gray	None Detected	
64	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
65	THROUGHOUT	1	LAYER 1 4" Cove Base, Gray	None Detected	
65	THROUGHOUT	2	LAYER 2 Adhesive, Cream	None Detected	
65	THROUGHOUT	3	LAYER 3 Adhesive, Brown	None Detected	
66	THROUGHOUT	1	LAYER 1 4" Cove Base, Gray	None Detected	
66	THROUGHOUT	2	LAYER 2 Adhesive, Cream	None Detected	
66	THROUGHOUT	3	LAYER 3 Adhesive, Brown	None Detected	
67	THROUGHOUT	1	LAYER 1 4" Cove Base, Gray	None Detected	
67	THROUGHOUT	2	LAYER 2 Adhesive, Cream	None Detected	
67	THROUGHOUT	3	LAYER 3 Adhesive, Brown	None Detected	
68	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	1	LAYER 1 12" Floor Tile, Dk./ Lt. Gray	None Detected	
68	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	2	LAYER 2 Mastic, Yellow/ Black	Chrysotile	3%
69	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	1	LAYER 1 12" Floor Tile, Dk./ Lt. Gray	None Detected	
69	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
70	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	1	LAYER 1 12" Floor Tile, Dk./ Lt. Gray	None Detected	
70	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
71	INT. WALLS T.O.	1	LAYER 1 CMU Block, Gray/ Black	None Detected	

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
71	INT. WALLS T.O.	2	LAYER 2 Mortar, Beige	None Detected	
71	INT. WALLS T.O.	3	LAYER 3 Paint/ Coating, White/ Off White	None Detected	
72	INT. WALLS T.O.	1	LAYER 1 CMU Block, Gray/ Black	None Detected	
72	INT. WALLS T.O.	2	LAYER 2 Mortar, Beige	None Detected	
72	INT. WALLS T.O.	3	LAYER 3 Paint/ Coating, White/ Off White	None Detected	
73	INT. WALLS T.O.	1	LAYER 1 CMU Block, Gray/ Black	None Detected	
73	INT. WALLS T.O.	2	LAYER 2 Mortar, Beige	None Detected	
73	INT. WALLS T.O.	3	LAYER 3 Paint/ Coating, White/ Off White	None Detected	
74	DECKING/WALLS	1	LAYER 1 Concrete, Gray	None Detected	
74	DECKING/WALLS	2	LAYER 2 Debris/ Mastic, Black	None Detected	
75	DECKING/WALLS	1	LAYER 1 Concrete, Gray	None Detected	
75	DECKING/WALLS	2	LAYER 2 Debris/ Mastic, Black	None Detected	
76	DECKING/WALLS	1	LAYER 1 Concrete, Gray	None Detected	
76	DECKING/WALLS	2	LAYER 2 Debris/ Mastic, Black	None Detected	
77	COMM/REC RM	1	LAYER 1 12" Floor Tile, White w/ Blue	None Detected	
77	COMM/REC RM	2	LAYER 2 Mastic, Yellow/ Black	Chrysotile	5%
78	COMM/REC RM	1	LAYER 1 12" Floor Tile, White w/ Blue	None Detected	
78	COMM/REC RM	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
79	COMM/REC RM	1	LAYER 1 12" Floor Tile, White w/ Blue	None Detected	
79	COMM/REC RM	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
80	COMM/REC RM	1	LAYER 1 12" Floor Tile, Sky Blue w/ Blue	None Detected	
80	COMM/REC RM	2	LAYER 2 Mastic, Yellow/ Black	Chrysotile	5%

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
81	COMM/REC RM	1	LAYER 1 12" Floor Tile, Sky Blue w/ Blue	None Detected	
81	COMM/REC RM	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
82	COMM/REC RM	1	LAYER 1 12" Floor Tile, Sky Blue w/ Blue	None Detected	
82	COMM/REC RM	2	LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request		
83	REC OFF, 1ST FL HALL	1	2x2 Ceiling Tile Gouge w/ Pinhole, White/ Beige	None Detected	
84	REC OFF, 1ST FL HALL	1	2x2 Ceiling Tile Gouge w/ Pinhole, White/ Beige	None Detected	
85	REC OFF, 1ST FL HALL	1	2x2 Ceiling Tile Gouge w/ Pinhole, White/ Beige	None Detected	
86	LOBBY	1	LAYER 1 12" Floor Tile, Brown	None Detected	
86	LOBBY	2	LAYER 2 Mastic, Yellow	None Detected	
87	LOBBY	1	LAYER 1 12" Floor Tile, Brown	None Detected	
87	LOBBY	2	LAYER 2 Mastic, Yellow	None Detected	
88	LOBBY	1	LAYER 1 12" Floor Tile, Yellow	None Detected	
88	LOBBY	2	LAYER 2 Mastic, Yellow	None Detected	
89	LOBBY	1	LAYER 1 12" Floor Tile, Yellow	None Detected	
89	LOBBY	2	LAYER 2 Mastic, Yellow	None Detected	
90	LOBBY	1	LAYER 1 12" Floor Tile, Blue w/ Dk. Blue	None Detected	
90	LOBBY	2	LAYER 2 Mastic, Yellow	None Detected	
91	LOBBY	1	LAYER 1 12" Floor Tile, Blue w/ Dk. Blue	None Detected	
91	LOBBY	2	LAYER 2 Mastic, Yellow	None Detected	
92	MAIN. SHOP HALL, BOILER RM	1	LAYER 1 4" Pipe Elbow, Gray	None Detected	
92	MAIN. SHOP HALL, BOILER RM	2	LAYER 2 4" Pipe Elbow Wrap, Beige	None Detected	
93	MAIN. SHOP HALL, BOILER RM	1	LAYER 1 4" Pipe Elbow, Gray	None Detected	
93	MAIN. SHOP HALL, BOILER RM	2	LAYER 2 4" Pipe Elbow Wrap, Off White/ Beige	None Detected	

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
94	MAIN. SHOP HALL, BOILER RM	1	LAYER 1 4" Pipe Elbow, Gray	None Detected	
94	MAIN. SHOP HALL, BOILER RM	2	LAYER 2 4" Pipe Elbow Wrap, Off White/ Beige	None Detected	
95	BOILER RM	1	LAYER 1 8" Pipe Insulation, Yellow	None Detected	
95	BOILER RM	2	LAYER 2 8" Pipe Wrap, Off White/ White	None Detected	
96	BOILER RM	1	LAYER 1 8" Pipe Insulation, Yellow	None Detected	
96	BOILER RM	2	LAYER 2 8" Pipe Wrap, White/ Silver	None Detected	
97	BOILER RM	1	LAYER 1 8" Pipe Insulation, Yellow	None Detected	
97	BOILER RM	2	LAYER 2 8" Pipe Wrap, White/ Silver	None Detected	
98	BOILER RM	1	LAYER 1 8" Pipe Elbow, Gray	None Detected	
98	BOILER RM	2	LAYER 2 8" Pipe Elbow Wrap, Off White/ White	None Detected	
99	BOILER RM	1	LAYER 1 8" Pipe Elbow, Gray	None Detected	
99	BOILER RM	2	LAYER 2 8" Pipe Elbow Wrap, Off White/ White	None Detected	
100	BOILER RM	1	LAYER 1 8" Pipe Elbow, Gray	None Detected	
100	BOILER RM	2	LAYER 2 8" Pipe Elbow Wrap, Off White/ White	None Detected	
101	TRASH RM	1	LAYER 1 12" Pipe Insulation, Tan	Chrysotile	3%
101	TRASH RM	2	LAYER 2 12" Pipe Insulation, Off White	Chrysotile	85%
101	TRASH RM	3	LAYER 3 12" Pipe Insulation Wrap, White/ Off White Note: Difficult to separate adjacent layer	Chrysotile	2%
102	TRASH RM	1	LAYER 1 12" Pipe Insulation, Tan Note: *Not analyzed per client request		
102	TRASH RM	2	LAYER 2 12" Pipe Insulation, Off White Note: *Not analyzed per client request		
102	TRASH RM	3	LAYER 3 12" Pipe Insulation Wrap, White/ Off White		

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
			Note: *Not analyzed per client request		
103	TRASH RM	1	LAYER 1 12" Pipe Insulation, Tan Note: *Not analyzed per client request		
103	TRASH RM	2	LAYER 2 12" Pipe Insulation, Off White Note: *Not analyzed per client request		
103	TRASH RM	3	LAYER 3 12" Pipe Insulation Wrap, White/ Off White Note: *Not analyzed per client request		
104	TRASH RM	1	LAYER 1 12" Pipe Elbow, Gray	Chrysotile	3%
104	TRASH RM	2	LAYER 2 12" Pipe Elbow Wrap, White/ Off White	None Detected	
105	TRASH RM	1	LAYER 1 12" Pipe Elbow, Gray Note: *Not analyzed per client request		
105	TRASH RM	2	LAYER 2 12" Pipe Elbow Wrap, White/ Off White	None Detected	
106	TRASH RM	1	LAYER 1 12" Pipe Elbow, Gray Note: *Not analyzed per client request		
106	TRASH RM	2	LAYER 2 12" Pipe Elbow Wrap, White/ Off White	None Detected	
107	TRASH RM	1	LAYER 1 24" Pipe Insulation, Gray	Chrysotile	3%
107	TRASH RM	2	LAYER 2 24" Pipe Insulation, Off White	Chrysotile	85%
107	TRASH RM	3	LAYER 3 24" Pipe Insulation Wrap, White/ Off White Note: Difficult to separate adjacent layer	Chrysotile	2%
108	TRASH RM	1	LAYER 1 24" Pipe Insulation, Gray Note: *Not analyzed per client request		
108	TRASH RM	2	LAYER 2 24" Pipe Insulation, Off White Note: *Not analyzed per client request		

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
108	TRASH RM	3	LAYER 3 24" Pipe Insulation Wrap, White/ Off White Note: *Not analyzed per client request		
109	TRASH RM	1	LAYER 1 24" Pipe Insulation, Gray Note: *Not analyzed per client request		
109	TRASH RM	2	LAYER 2 24" Pipe Insulation, Off White Note: *Not analyzed per client request		
109	TRASH RM	3	LAYER 3 24" Pipe Insulation Wrap, White/ Off White Note: *Not analyzed per client request		
110	TRASH RM	1	LAYER 1 24" Pipe Elbows, Gray	Chrysotile	3%
110	TRASH RM	2	LAYER 2 24" Pipe Elbows, Off White	Chrysotile	85%
110	TRASH RM	3	LAYER 3 24" Pipe Elbows Wrap, White/ Off White Note: Difficult to separate adjacent layer	Chrysotile	2%
111	TRASH RM	1	LAYER 1 24" Pipe Elbows, Gray Note: *Not analyzed per client request		
111	TRASH RM	2	LAYER 2 24" Pipe Elbows, Off White Note: *Not analyzed per client request		
111	TRASH RM	3	LAYER 3 24" Pipe Elbows Wrap, White/ Off White Note: *Not analyzed per client request		
112	TRASH RM	1	LAYER 1 24" Pipe Elbows, Gray Note: *Not analyzed per client request		
112	TRASH RM	2	LAYER 2 24" Pipe Elbows, Off White Note: *Not analyzed per client request		
112	TRASH RM	3	LAYER 3 24" Pipe Elbows Wrap, White/ Off White		

Sample#	Sample Location	Layer#	Description	Asbestos Type	Asbestos%
			Note: *Not analyzed per client request		
113	EXT.	1	LAYER 1 Brick, Brown/ Gray	None Detected	
113	EXT.	2	LAYER 2 Mortar, Beige	None Detected	
114	EXT.	1	LAYER 1 Brick, Brown/ Gray	None Detected	
114	EXT.	2	LAYER 2 Mortar, Beige	None Detected	
115	EXT.	1	LAYER 1 Brick, Brown/ Gray	None Detected	
115	EXT.	2	LAYER 2 Mortar, Beige	None Detected	
116	WINDOW/DOOR FRAMES	1	Caulk, Brown	None Detected	
117	WINDOW/DOOR FRAMES	1	Caulk, Brown	None Detected	
118	WINDOW/DOOR FRAMES	1	Caulk, Brown	None Detected	
119	BASE OF EXT. WALL/SIDEWALK	1	Caulk, Beige	None Detected	
120	BASE OF EXT. WALL/SIDEWALK	1	Caulk, Beige	None Detected	
121	BASE OF EXT. WALL/SIDEWALK	1	Caulk, Beige	None Detected	

APPENDIX A

LABORATORY ANALYTICAL DATA

EMC LABS, INC.

9830 S. 51st Street, Suite B109, Phoenix, AZ 85044
Phone: 800-362-3373 or 480-940-5294 - Fax: (480) 893-1726

Laboratory Report
0248289

Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client: RISKNOMICS Job# / P.O. #: 20RN2260
Address: 8777 E. VIA DE VENTURA, SUITE 188 Date Received: 01/22/2021
SCOTTSDALE, AZ 85258 Date Analyzed: 01/29/2021
Collected: 01/19/2021 Date Reported: 01/29/2021
Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-001 1	T.O. 1311, 610, OFF BRK RM CL	LAYER 1 Drywall, White/ Brown	No	None Detected	Cellulose Fiber	12%
		LAYER 2 Joint Compound, White	No	None Detected	Gypsum Quartz Carbonates Mica	88%
		LAYER 3 Tape, Off White	No	None Detected	Carbonates Mica Quartz Perlite Binder/Filler	100%
		LAYER 4 Texture, White/ Off White	No	None Detected	Cellulose Fiber Carbonates	95% 5%
					Carbonates Mica Quartz Perlite Binder/Filler	100%

EMC LABS, INC.

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Laboratory Report
0248289

Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client: RISKNOMICS Job# / P.O. #: 20RN2260
Address: 8777 E. VIA DE VENTURA, SUITE 188 Date Received: 01/22/2021
SCOTTSDALE, AZ 85258 Date Analyzed: 01/29/2021
Collected: 01/19/2021 Date Reported: 01/29/2021
Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-002 2	T.O. 1311, 610, OFF BRK RM CL	LAYER 1 Drywall, White/ Brown	No	None Detected	Cellulose Fiber	12%
		LAYER 2 Joint Compound, White	No	None Detected	Gypsum Quartz Carbonates Mica	88%
		LAYER 3 Tape, Off White	No	None Detected	Cellulose Fiber	<1%
		LAYER 4 Texture, White/ Off White	No	None Detected	Carbonates Mica Quartz Perlite Binder/Filler	99%
					Cellulose Fiber	95%
					Carbonates	5%
					Carbonates Mica Quartz Perlite Binder/Filler	100%

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Laboratory Report
0248289

Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client: RISKNOMICS Job# / P.O. #: 20RN2260
Address: 8777 E. VIA DE VENTURA, SUITE 188 Date Received: 01/22/2021
SCOTTSDALE, AZ 85258 Date Analyzed: 01/29/2021
Collected: 01/19/2021 Date Reported: 01/29/2021
Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-003 3	T.O. 1311, 610, OFF BRK RM CL	LAYER 1 Drywall, White/ Brown	No	None Detected	Cellulose Fiber	12%
		LAYER 2 Joint Compound, White	No	None Detected	Gypsum Quartz Carbonates Mica	88%
		LAYER 3 Tape, Off White	No	None Detected	Carbonates Gypsum Mica Quartz Perlite Binder/Filler	100%
		LAYER 4 Texture, White/ Yellow	No	None Detected	Cellulose Fiber Carbonates	95% 5%
0248289-004 4	T.O.	LAYER 1 9" Vinyl Floor Tile, Gray/ White/ Streaks	Yes	Chrysotile 3%	Carbonates Quartz Binder/Filler	97%
		LAYER 2 Mastic, Black	Yes	Chrysotile 10%	Carbonates Quartz Binder/Filler	90%

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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-005 5	T.O.	LAYER 1 9" Vinyl Floor Tile, Gray/ White/ Streaks Note: *Not analyzed per client request LAYER 2 Mastic, Black Note: *Not analyzed per client request			
0248289-006 6	T.O.	LAYER 1 9" Vinyl Floor Tile, Gray/ White/ Streaks Note: *Not analyzed per client request LAYER 2 Mastic, Black Note: *Not analyzed per client request			
0248289-007 7	T.O.11TH FL STOR, POOL RM	LAYER 1 4" Cove Base, Brown LAYER 2 Adhesive, Brown	No	None Detected	Carbonates Quartz Binder/Filler 100% Wollastonite 3% Carbonates Quartz Binder/Filler 97%

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Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-008 8	T.O.11TH FL STOR, POOL RM	LAYER 1 4" Cove Base, Brown	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Brown	No	None Detected	Wollastonite 3% Carbonates Quartz Binder/Filler 97%
0248289-009 9	T.O.11TH FL STOR, POOL RM	LAYER 1 4" Cove Base, Brown	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Brown	No	None Detected	Wollastonite 3% Cellulose Fiber <1% Carbonates Quartz Binder/Filler 96%
0248289-010 10	(SHOWER)...1302,1 304,1301,1305,1312, 1209,1208,1201,110 5,1112,1010,1008,10 05..	LAYER 1 Ceramic Tile, White	No	None Detected	Quartz Gypsum Binder/Filler 100%
		LAYER 2 Grout, Off White	No	None Detected	Carbonates Gypsum Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Yellow	No	None Detected	Quartz Gypsum Binder/Filler 100%

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Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-011 11	(SHOWER)...1302,1 304,1301,1305,1312, 1209,1208,1201,110 5,1112,1010,1008,10 05..	LAYER 1 Ceramic Tile, White	No	None Detected	Quartz Gypsum Binder/Filler 100%
		LAYER 2 Grout, Off White	No	None Detected	Carbonates Gypsum Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Yellow	No	None Detected	Quartz Gypsum Binder/Filler 100%
0248289-012 12	(SHOWER)...1302,1 304,1301,1305,1312, 1209,1208,1201,110 5,1112,1010,1008,10 05..	LAYER 1 Ceramic Tile, White	No	None Detected	Quartz Gypsum Binder/Filler 100%
		LAYER 2 Grout, Off White	No	None Detected	Carbonates Gypsum Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Yellow	No	None Detected	Quartz Gypsum Binder/Filler 100%

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Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-013 13	(KITCHEN)1302	Sink Coating, Black	Yes	Chrysotile 5%	Carbonates Quartz Binder/Filler 95%
0248289-014 14	(KITCHEN)1302	Sink Coating, Black Note: *Not analyzed per client request			
0248289-015 15	(KITCHEN)1302	Sink Coating, Black Note: *Not analyzed per client request			
0248289-016 16	T.O.	Popcorn Ceiling Texture, White/ Off White	No	None Detected	Carbonates Mica Quartz Perlite Binder/Filler 100%
0248289-017 17	T.O.	Popcorn Ceiling Texture, White/ Beige	No	None Detected	Carbonates Mica Quartz Perlite Binder/Filler 100%
0248289-018 18	T.O.	Popcorn Ceiling Texture, White/ Beige	Yes	Chrysotile 3%	Carbonates Mica Quartz Binder/Filler 97%
0248289-019 19	T.O.	Popcorn Ceiling Texture, White/ Beige Note: *Not analyzed per client request			

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Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-020 20	T.O.	Popcorn Ceiling Texture, White/ Beige Note: *Not analyzed per client request			
0248289-021 21	T.O.	Popcorn Ceiling Texture, White/ Beige Note: *Not analyzed per client request			
0248289-022 22	T.O.	Popcorn Ceiling Texture, White/ Beige Note: *Not analyzed per client request			
0248289-023 23	1304,1301,1305,120 1,1006,806,501,409,4 08,407,406,401,285,1 01,OFF BRK RM	Sink Caulking, White	No	None Detected	Cellulose Fiber 10% Carbonates Mica Quartz Binder/Filler 90%
0248289-024 24	1304,1301,1305,120 1,1006,806,501,409,4 08,407,406,401,285,1 01,OFF BRK RM	Sink Caulking, White	No	None Detected	Cellulose Fiber 10% Carbonates Mica Quartz Binder/Filler 90%

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Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-025 25	1304,1301,1305,120 1,1006,806,501,409,4 08,407,406,401,285,1 01,OFF BRK RM	Sink Caulking, White	No	None Detected	Cellulose Fiber	10%
					Carbonates Mica Quartz Binder/Filler	90%
0248289-026 26	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	LAYER 1 Fiberglass, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 Pipe Wrap, Off White/ Lt. Beige	No	None Detected	Synthetic Fiber	30%
					Carbonates Quartz Binder/Filler	70%
0248289-027 27	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	LAYER 1 Fiberglass, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 Pipe Wrap, Off White/ Lt. Beige	No	None Detected	Synthetic Fiber	30%
					Carbonates Quartz Binder/Filler	70%
0248289-028 28	ELEV PENTHOUSE, BATHRMS, MAINT. SHOP	LAYER 1 Fiberglass, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 Pipe Wrap, Off White/ Lt. Beige	No	None Detected	Synthetic Fiber	30%
					Carbonates Quartz Binder/Filler	70%

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Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-029 29	1312....202, 1ST FL, REC. RM	LAYER 1 4" Cove Base, Black	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Brown	No	None Detected	Cellulose Fiber <1% Quartz Gypsum Carbonates Binder/Filler 99%
		LAYER 4 Compound, Beige	Yes	Chrysotile 3%	Cellulose Fiber 1% Carbonates Mica Quartz Binder/Filler 96%

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Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
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Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-030 30	1312....202, 1ST FL, REC. RM	LAYER 1 4" Cove Base, Black	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Brown	No	None Detected	Cellulose Fiber 1% Quartz Gypsum Carbonates Binder/Filler 99%
		LAYER 4 Compound, Beige Note: *Not analyzed per client request			
0248289-031 31	1312....202, 1ST FL, REC. RM	LAYER 1 4" Cove Base, Black	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Brown	No	None Detected	Cellulose Fiber <1% Quartz Gypsum Carbonates Binder/Filler 99%
		LAYER 4 Compound, Beige Note: *Not analyzed per client request			

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Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-032 32	1311, 1201, 903, 501	LAYER 1 12" Vinyl Floor Tile, Beige w/ Red/ White Streaks	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Mastic - Top, Yellow	No	None Detected	Cellulose Fiber Carbonates Quartz Binder/Filler <1% 99%
0248289-033 33	1311, 1201, 903, 501	LAYER 1 12" Vinyl Floor Tile, Beige w/ Red/ White Streaks	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Mastic - Top, Yellow	No	None Detected	Cellulose Fiber Carbonates Quartz Binder/Filler <1% 99%

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Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-034 34	1311, 1201, 903, 501	LAYER 1 12" Vinyl Floor Tile, Beige w/ Red/ White Streaks	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Mastic - Top, Yellow	No	None Detected	Synthetic Fiber <1% Carbonates Quartz Binder/Filler 99%
0248289-035 35	1207,1010,810,709,3 02,310,209,101, 1ST- 4" Cove Base, Beige 13TH FL HALLWAYS, POOL RM, MAINT RM.	LAYER 1	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Cellulose Fiber 1% Carbonates Quartz Binder/Filler 99%
		LAYER 3 Compound, White	Yes	Chrysotile 2%	Carbonates Mica Quartz Binder/Filler 98%

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Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-036 36	1207,1010,810,709,3 02,310,209,101, 1ST- 4" Cove Base, Beige 13TH FL HALLWAYS, POOL RM, MAINT RM.	LAYER 1	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Carbonates Quartz Binder/Filler 100%
0248289-037 37	1207,1010,810,709,3 02,310,209,101, 1ST- 4" Cove Base, Beige 13TH FL HALLWAYS, POOL RM, MAINT RM.	LAYER 1	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Brown	No	None Detected	Quartz Carbonates Binder/Filler 100%

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Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-038 38	1206,1201,1006,101 3,810, 7TH FL COUNSELOR OFF, 713,707,709,611,505, 508,202	LAYER 1 12" Vinyl Floor Tile, Beige w/ Lt.Red White Blotches	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Brown/ Black	Yes	Chrysotile 5%	Cellulose Fiber <1% Carbonates Quartz Binder/Filler 94%
0248289-039 39	1206,1201,1006,101 3,810, 7TH FL COUNSELOR OFF, 713,707,709,611,505, 508,202	LAYER 1 12" Vinyl Floor Tile, Beige w/ Lt.Red White Blotches	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request			
0248289-040 40	1206,1201,1006,101 3,810, 7TH FL COUNSELOR OFF, 713,707,709,611,505, 508,202	LAYER 1 12" Vinyl Floor Tile, Beige w/ Lt.Red White Blotches	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request			

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Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-041 41	LAUNDRY 12TH FL, END OF HALLWAYS	LAYER 1 4" Fiberglass, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 4" Pipe Wrap, White/ Off White	No	None Detected	Synthetic Fiber Carbonates Quartz Binder/Filler	30% 70%
0248289-042 42	LAUNDRY 12TH FL, END OF HALLWAYS	LAYER 1 4" Fiberglass, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 4" Pipe Wrap, White/ Off White	No	None Detected	Synthetic Fiber Carbonates Quartz Binder/Filler	30% 70%
0248289-043 43	LAUNDRY 12TH FL, END OF HALLWAYS	LAYER 1 4" Fiberglass, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 4" Pipe Wrap, White/ Off White	No	None Detected	Synthetic Fiber Carbonates Quartz Binder/Filler	30% 70%
0248289-044 44	1103	LAYER 1 12" Floor Tile, White w/ Gray	No	None Detected	Carbonates Quartz Binder/Filler	100%
		LAYER 2 Mastic, Brown/ Black	Yes	Chrysotile 5%	Cellulose Fiber Quartz Carbonates Binder/Filler	<1% 94%

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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-045 45	1103	LAYER 1 12" Floor Tile, White w/ Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request			
0248289-046 46	1103	LAYER 1 12" Floor Tile, White w/ Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request			
0248289-047 47	1010-RR, 1011- PATCH, 913-RR, 610-PATCH, 401- RR, 403-PATCH, 309-BED, 209	LAYER 1 9" Vinyl Floor Tile, White w/ Black Streaks	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Brown/ Black	Yes	Chrysotile 5%	Cellulose Fiber 1% Carbonates Quartz Binder/Filler 94%

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Laboratory Report
0248289

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Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-048 48	1010-RR, 1011- PATCH, 913-RR, 610-PATCH, 401- RR, 403-PATCH, 309-BED, 209	LAYER 1 9" Vinyl Floor Tile, White w/ Black Streaks LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request	No	None Detected	Carbonates Quartz Binder/Filler 100%
0248289-049 49	1010-RR, 1011- PATCH, 913-RR, 610-PATCH, 401- RR, 403-PATCH, 309-BED, 209	LAYER 1 9" Vinyl Floor Tile, White w/ Black Streaks LAYER 2 Mastic, Brown/ Black Note: *Not analyzed per client request	No	None Detected	Carbonates Quartz Binder/Filler 100%
0248289-050 50	101-PUBLIC RR'S (2), COMM/REC RM, POOL RM, MAINT. LOCKER RM & OFFICES	2x2 Ceiling Tile Pinhole & Fissure, White/ Beige	No	None Detected	Mineral Wool Cellulose Fiber Carbonates Quartz Perlite Binder/Filler 45% 35% 20%

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Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-051 51	101-PUBLIC RR'S (2), COMM/REC RM, POOL RM, MAINT. LOCKER RM & OFFICES	2x2 Ceiling Tile Pinhole & Fissure, White/ Beige	No	None Detected	Mineral Wool 45% Cellulose Fiber 35% Carbonates Quartz Perlite Binder/Filler 20%
0248289-052 52	101-PUBLIC RR'S (2), COMM/REC RM, POOL RM, MAINT. LOCKER RM & OFFICES	2x2 Ceiling Tile Pinhole & Fissure, White/ Beige	No	None Detected	Mineral Wool 45% Cellulose Fiber 35% Carbonates Quartz Perlite Binder/Filler 20%
0248289-053 53	ABOVE DROP CEILING, 1ST FL. MAINT SHOP	2" Pipe Elbow, Gray	Yes	Chrysotile 3%	Mineral Wool 25% Gypsum Diatoms Carbonates Quartz 72%
0248289-054 54	ABOVE DROP CEILING, 1ST FL. MAINT SHOP	2" Pipe Elbow, Gray Note: *Not analyzed per client request			
0248289-055 55	ABOVE DROP CEILING, 1ST FL. MAINT SHOP	2" Pipe Elbow, Gray Note: *Not analyzed per client request			

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Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-056 56	OFFICES (3)	Carpet Square Mastic, Green	No	None Detected	Carbonates Quartz Binder/Filler	100%
0248289-057 57	OFFICES (3)	Carpet Square Mastic, Green	No	None Detected	Synthetic Fiber Carbonates Quartz Binder/Filler	<1% 99%
0248289-058 58	OFFICES (3)	Carpet Square Mastic, Green	No	None Detected	Synthetic Fiber Carbonates Quartz Binder/Filler	<1% 99%
0248289-059 59	UNDER CARPET SQ	LAYER 1 12" Floor Tile, White w/ Gray	No	None Detected	Carbonates Quartz Binder/Filler	100%
		LAYER 2 Mastic, Yellow/ Black	Yes	Chrysotile 3%	Carbonates Quartz Binder/Filler	97%
		LAYER 3 Carpet Mastic, Green	No	None Detected	Cellulose Fiber Synthetic Fiber Carbonates Quartz Binder/Filler	1% <1% 98%

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Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-060 60	UNDER CARPET SQ	LAYER 1 12" Floor Tile, White w/ Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			
		LAYER 3 Carpet Mastic, Green	No	None Detected	Cellulose Fiber Synthetic Fiber Carbonates Quartz Binder/Filler 1% <1% 98%
0248289-061 61	UNDER CARPET SQ	LAYER 1 12" Floor Tile, White w/ Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			
		LAYER 3 Carpet Mastic, Green	No	None Detected	Cellulose Fiber Carbonates Quartz Binder/Filler <1% 99%

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Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-062 62	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	LAYER 1 12" Floor Tile, Blue/ Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: Very small amount of black mastic	Yes	Chrysotile 2%	Carbonates Quartz Binder/Filler 98%
0248289-063 63	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	LAYER 1 12" Floor Tile, Blue/ Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			
0248289-064 64	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)	LAYER 1 12" Floor Tile, Blue/ Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			

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Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-065 65	THROUGHOUT	LAYER 1 4" Cove Base, Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Brown	No	None Detected	Quartz Gypsum Binder/Filler 100%
0248289-066 66	THROUGHOUT	LAYER 1 4" Cove Base, Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Brown	No	None Detected	Cellulose Fiber Quartz Gypsum Binder/Filler <1% 99%

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Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-067 67	THROUGHOUT	LAYER 1 4" Cove Base, Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Adhesive, Cream	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 3 Adhesive, Brown	No	None Detected	Quartz Gypsum Binder/Filler 100%
0248289-068 68	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	LAYER 1 12" Floor Tile, Dk./ Lt. Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black	Yes	Chrysotile 3%	Cellulose Fiber <1% Carbonates Quartz Binder/Filler 96%

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		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-069 69	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	LAYER 1 12" Floor Tile, Dk./ Lt. Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			
0248289-070 70	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT. LOCKER RM & OFFICE	LAYER 1 12" Floor Tile, Dk./ Lt. Gray	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			

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Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-071 71	INT. WALLS T.O.	LAYER 1 CMU Block, Gray/ Black	No	None Detected	Gypsum Quartz Carbonates Binder/Filler 100%
		LAYER 2 Mortar, Beige	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%
		LAYER 3 Paint/ Coating, White/ Off White	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%
0248289-072 72	INT. WALLS T.O.	LAYER 1 CMU Block, Gray/ Black	No	None Detected	Gypsum Quartz Carbonates Binder/Filler 100%
		LAYER 2 Mortar, Beige	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%
		LAYER 3 Paint/ Coating, White/ Off White	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%

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0248289-073 73	INT. WALLS T.O.	LAYER 1 CMU Block, Gray/ Black	No	None Detected	Gypsum Quartz Carbonates Binder/Filler 100%
		LAYER 2 Mortar, Beige	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%
		LAYER 3 Paint/ Coating, White/ Off White	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%
0248289-074 74	DECKING/WALLS	LAYER 1 Concrete, Gray	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%
		LAYER 2 Debris/ Mastic, Black	No	None Detected	Synthetic Fiber Carbonates Gypsum Quartz Binder/Filler 99%

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		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-075 75	DECKING/WALLS	LAYER 1 Concrete, Gray	No	None Detected	Carbonates Quartz Gypsum Mica Binder/Filler 100%
		LAYER 2 Debris/ Mastic, Black	No	None Detected	Cellulose Fiber <1% Carbonates Gypsum Quartz Binder/Filler 99%
0248289-076 76	DECKING/WALLS	LAYER 1 Concrete, Gray	No	None Detected	Carbonates Quartz Gypsum Mica Binder/Filler 100%
		LAYER 2 Debris/ Mastic, Black	No	None Detected	Carbonates Gypsum Quartz Binder/Filler 100%
0248289-077 77	COMM/REC RM	LAYER 1 12" Floor Tile, White w/ Blue	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black	Yes	Chrysotile 5%	Carbonates Quartz Binder/Filler 95%

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		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-078 78	COMM/REC RM	LAYER 1 12" Floor Tile, White w/ Blue	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			
0248289-079 79	COMM/REC RM	LAYER 1 12" Floor Tile, White w/ Blue	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			
0248289-080 80	COMM/REC RM	LAYER 1 12" Floor Tile, Sky Blue w/ Blue	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black	Yes	Chrysotile 5%	Carbonates Quartz Binder/Filler 95%
0248289-081 81	COMM/REC RM	LAYER 1 12" Floor Tile, Sky Blue w/ Blue	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request			

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0248289-082 82	COMM/REC RM	LAYER 1 12" Floor Tile, Sky Blue w/ Blue	No	None Detected	Carbonates Quartz Binder/Filler	100%
		LAYER 2 Mastic, Yellow/ Black Note: *Not analyzed per client request				
0248289-083 83	REC OFF, 1ST FL HALL	2x2 Ceiling Tile Gouge w/ Pinhole, White/ Beige	No	None Detected	Cellulose Fiber Mineral Wool Carbonates Gypsum Quartz Perlite Binder/Filler	60% 20% 20%
0248289-084 84	REC OFF, 1ST FL HALL	2x2 Ceiling Tile Gouge w/ Pinhole, White/ Beige	No	None Detected	Cellulose Fiber Mineral Wool Carbonates Gypsum Quartz Perlite Binder/Filler	60% 20% 20%
0248289-085 85	REC OFF, 1ST FL HALL	2x2 Ceiling Tile Gouge w/ Pinhole, White/ Beige	No	None Detected	Cellulose Fiber Mineral Wool Carbonates Gypsum Quartz Perlite Binder/Filler	60% 20% 20%

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Collected By:

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0248289-086 86	LOBBY	LAYER 1 12" Floor Tile, Brown	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Quartz Carbonates Binder/Filler 100%
0248289-087 87	LOBBY	LAYER 1 12" Floor Tile, Brown	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Quartz Carbonates Binder/Filler 100%
0248289-088 88	LOBBY	LAYER 1 12" Floor Tile, Yellow	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Quartz Carbonates Binder/Filler 100%
0248289-089 89	LOBBY	LAYER 1 12" Floor Tile, Yellow	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Quartz Carbonates Binder/Filler 100%

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Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-090 90	LOBBY	LAYER 1 12" Floor Tile, Blue w/ Dk. Blue	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Cellulose Fiber <1% Quartz Carbonates Binder/Filler 99%
0248289-091 91	LOBBY	LAYER 1 12" Floor Tile, Blue w/ Dk. Blue	No	None Detected	Carbonates Quartz Binder/Filler 100%
		LAYER 2 Mastic, Yellow	No	None Detected	Quartz Carbonates Binder/Filler 100%
0248289-092 92	MAIN. SHOP HALL, BOILER RM	LAYER 1 4" Pipe Elbow, Gray	No	None Detected	Mineral Wool 30% Gypsum Quartz Carbonates Perlite Binder/Filler 70%
		LAYER 2 4" Pipe Elbow Wrap, Beige	No	None Detected	Carbonates Quartz Binder/Filler 100%

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Phone: 800-362-3373 or 480-940-5294 - Fax: (480) 893-1726

Laboratory Report
0248289

Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-093 93	MAIN. SHOP HALL, BOILER RM	LAYER 1 4" Pipe Elbow, Gray	No	None Detected	Mineral Wool	30%
					Gypsum Quartz Carbonates Perlite Binder/Filler	70%
		LAYER 2 4" Pipe Elbow Wrap, Off White/ Beige	No	None Detected	Synthetic Fiber	75%
					Carbonates Quartz Binder/Filler	25%
0248289-094 94	MAIN. SHOP HALL, BOILER RM	LAYER 1 4" Pipe Elbow, Gray	No	None Detected	Mineral Wool	30%
					Gypsum Quartz Carbonates Perlite Binder/Filler	70%
		LAYER 2 4" Pipe Elbow Wrap, Off White/ Beige	No	None Detected	Synthetic Fiber	75%
					Carbonates Quartz Binder/Filler	25%
0248289-095 95	BOILER RM	LAYER 1 8" Pipe Insulation, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 8" Pipe Wrap, Off White/ White	No	None Detected	Cellulose Fiber	75%
					Carbonates Quartz Binder/Filler	25%

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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-096 96	BOILER RM	LAYER 1 8" Pipe Insulation, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 8" Pipe Wrap, White/ Silver	No	None Detected	Cellulose Fiber Fibrous Glass Aluminum Carbonates Quartz Binder/Filler	35% 5% 60%
0248289-097 97	BOILER RM	LAYER 1 8" Pipe Insulation, Yellow	No	None Detected	Fibrous Glass	100%
		LAYER 2 8" Pipe Wrap, White/ Silver	No	None Detected	Cellulose Fiber Fibrous Glass Aluminum Carbonates Quartz Binder/Filler	35% 5% 60%
0248289-098 98	BOILER RM	LAYER 1 8" Pipe Elbow, Gray	No	None Detected	Mineral Wool Gypsum Quartz Carbonates Perlite Binder/Filler	25% 75%
		LAYER 2 8" Pipe Elbow Wrap, Off White/ White	No	None Detected	Cellulose Fiber Carbonates Quartz Binder/Filler	60% 40%

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Laboratory Report
0248289

Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents	
0248289-099 99	BOILER RM	LAYER 1 8" Pipe Elbow, Gray	No	None Detected	Mineral Wool Gypsum Quartz Carbonates Perlite Binder/Filler	25% 75%
		LAYER 2 8" Pipe Elbow Wrap, Off White/ White	No	None Detected	Cellulose Fiber Carbonates Quartz Binder/Filler	60% 40%
0248289-100 100	BOILER RM	LAYER 1 8" Pipe Elbow, Gray	No	None Detected	Mineral Wool Gypsum Quartz Carbonates Perlite Binder/Filler	25% 75%
		LAYER 2 8" Pipe Elbow Wrap, Off White/ White	No	None Detected	Cellulose Fiber Carbonates Quartz Binder/Filler	60% 40%
0248289-101 101	TRASH RM	LAYER 1 12" Pipe Insulation, Tan	Yes	Chrysotile 3%	Gypsum Quartz Perlite Binder/Filler	 97%
		LAYER 2 12" Pipe Insulation, Off White	Yes	Chrysotile 85%	Cellulose Fiber Carbonates Gypsum Binder/Filler	5% 10%
		LAYER 3 12" Pipe Insulation Wrap, White/ Off White Note: Difficult to separate adjacent layer	Yes	Chrysotile 2%	Cellulose Fiber Carbonates Quartz Binder/Filler	75% 23%

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Laboratory Report
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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-102 102	TRASH RM	LAYER 1 12" Pipe Insulation, Tan Note: *Not analyzed per client request LAYER 2 12" Pipe Insulation, Off White Note: *Not analyzed per client request LAYER 3 12" Pipe Insulation Wrap, White/ Off White Note: *Not analyzed per client request			
0248289-103 103	TRASH RM	LAYER 1 12" Pipe Insulation, Tan Note: *Not analyzed per client request LAYER 2 12" Pipe Insulation, Off White Note: *Not analyzed per client request LAYER 3 12" Pipe Insulation Wrap, White/ Off White Note: *Not analyzed per client request			
0248289-104 104	TRASH RM	LAYER 1 12" Pipe Elbow, Gray	Yes	Chrysotile 3%	Mineral Wool 25% Gypsum Diatoms Carbonates Quartz 72%
		LAYER 2 12" Pipe Elbow Wrap, White/ Off White	No	None Detected	Cellulose Fiber 70% Carbonates Quartz Binder/Filler 30%

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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-105 105	TRASH RM	LAYER 1 12" Pipe Elbow, Gray Note: *Not analyzed per client request			
		LAYER 2 12" Pipe Elbow Wrap, White/ Off White	No	None Detected	Cellulose Fiber 70% Carbonates Quartz Binder/Filler 30%
0248289-106 106	TRASH RM	LAYER 1 12" Pipe Elbow, Gray Note: *Not analyzed per client request			
		LAYER 2 12" Pipe Elbow Wrap, White/ Off White	No	None Detected	Cellulose Fiber 70% Carbonates Quartz Binder/Filler 30%
0248289-107 107	TRASH RM	LAYER 1 24" Pipe Insulation, Gray	Yes	Chrysotile 3%	Mineral Wool 25% Gypsum Carbonates Quartz Perlite Binder/Filler 72%
		LAYER 2 24" Pipe Insulation, Off White	Yes	Chrysotile 85%	Mineral Wool 3% Carbonates Gypsum Binder/Filler 12%
		LAYER 3 24" Pipe Insulation Wrap, White/ Off White Note: Difficult to separate adjacent layer	Yes	Chrysotile 2%	Synthetic Fiber 75% Carbonates Quartz Binder/Filler 23%

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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-108 108	TRASH RM	LAYER 1 24" Pipe Insulation, Gray Note: *Not analyzed per client request LAYER 2 24" Pipe Insulation, Off White Note: *Not analyzed per client request LAYER 3 24" Pipe Insulation Wrap, White/ Off White Note: *Not analyzed per client request			
0248289-109 109	TRASH RM	LAYER 1 24" Pipe Insulation, Gray Note: *Not analyzed per client request LAYER 2 24" Pipe Insulation, Off White Note: *Not analyzed per client request LAYER 3 24" Pipe Insulation Wrap, White/ Off White Note: *Not analyzed per client request			

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Laboratory Report
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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-110 110	TRASH RM	LAYER 1 24" Pipe Elbows, Gray	Yes	Chrysotile 3%	Mineral Wool 25% Cellulose Fiber 2% Gypsum Carbonates Quartz Perlite Binder/Filler 70%
		LAYER 2 24" Pipe Elbows, Off White	Yes	Chrysotile 85%	Mineral Wool 5% Carbonates Gypsum Binder/Filler 10%
		LAYER 3 24" Pipe Elbows Wrap, White/ Off White Note: Difficult to separate adjacent layer	Yes	Chrysotile 2%	Synthetic Fiber 75% Carbonates Quartz Binder/Filler 23%
0248289-111 111	TRASH RM	LAYER 1 24" Pipe Elbows, Gray Note: *Not analyzed per client request			
		LAYER 2 24" Pipe Elbows, Off White Note: *Not analyzed per client request			
		LAYER 3 24" Pipe Elbows Wrap, White/ Off White Note: *Not analyzed per client request			

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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-112 112	TRASH RM	LAYER 1 24" Pipe Elbows, Gray Note: *Not analyzed per client request LAYER 2 24" Pipe Elbows, Off White Note: *Not analyzed per client request LAYER 3 24" Pipe Elbows Wrap, White/ Off White Note: *Not analyzed per client request			
0248289-113 113	EXT.	LAYER 1 Brick, Brown/ Gray	No	None Detected	Quartz Gypsum Binder/Filler 100%
		LAYER 2 Mortar, Beige	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%
0248289-114 114	EXT.	LAYER 1 Brick, Brown/ Gray	No	None Detected	Quartz Gypsum Binder/Filler 100%
		LAYER 2 Mortar, Beige	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%

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Laboratory Report
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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client: RISKNOMICS Job# / P.O. #: 20RN2260
Address: 8777 E. VIA DE VENTURA, SUITE 188 Date Received: 01/22/2021
SCOTTSDALE, AZ 85258 Date Analyzed: 01/29/2021
Collected: 01/19/2021 Date Reported: 01/29/2021
Project Name: BEECHWOOD-CINCINNATI, OH EPA Method: EPA 600/R-93/116
Address: Submitted By: CHRISTIAN MATECKI
Collected By:

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-115 115	EXT.	LAYER 1 Brick, Brown/ Gray	No	None Detected	Quartz Gypsum Binder/Filler 100%
		LAYER 2 Mortar, Beige	No	None Detected	Quartz Carbonates Gypsum Mica Binder/Filler 100%
0248289-116 116	WINDOW/DOOR FRAMES	Caulk, Brown	No	None Detected	Carbonates Quartz Binder/Filler 100%
0248289-117 117	WINDOW/DOOR FRAMES	Caulk, Brown	No	None Detected	Carbonates Quartz Binder/Filler 100%
0248289-118 118	WINDOW/DOOR FRAMES	Caulk, Brown	No	None Detected	Carbonates Quartz Binder/Filler 100%
0248289-119 119	BASE OF EXT. WALL/SIDEWALK	Caulk, Beige	No	None Detected	Cellulose Fiber <1% Carbonates Quartz Binder/Filler 99%

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Bulk Asbestos Analysis by Polarized Light Microscopy

NVLAP#101926-0

Client:	RISKNOMICS	Job# / P.O. #:	20RN2260
Address:	8777 E. VIA DE VENTURA, SUITE 188	Date Received:	01/22/2021
	SCOTTSDALE, AZ 85258	Date Analyzed:	01/29/2021
Collected:	01/19/2021	Date Reported:	01/29/2021
Project Name:	BEECHWOOD-CINCINNATI, OH	EPA Method:	EPA 600/R-93/116
Address:		Submitted By:	CHRISTIAN MATECKI
		Collected By:	

Lab ID Client ID	Sample Location	Layer Name / Sample Description	Asbestos Detected	Asbestos Type (%)	Non-Asbestos Constituents
0248289-120 120	BASE OF EXT. WALL/SIDEWALK	Caulk, Beige	No	None Detected	Carbonates Quartz Binder/Filler 100%
0248289-121 121	BASE OF EXT. WALL/SIDEWALK	Caulk, Beige	No	None Detected	Carbonates Quartz Binder/Filler 100%



Analyst - Octavio Gavarreteayestas



Signatory - Lab Director - Kurt Kettler

Distinctly stratified, easily separable layers of samples are analyzed as subsamples of the whole and are reported separately for each discernible layer. All analyses are derived from calibrated visual estimate and measured in area percent unless otherwise noted. The report applies to the standards or procedures identified and to the sample(s) tested. The test results are not necessarily indicated or representative of the qualities of the lot from which the sample was taken or of apparently identical or similar products, nor do they represent an ongoing quality assurance program unless so noted. These reports are for the exclusive use of the addressed client and that they will not be reproduced wholly or in part for advertising or other purposes over our signature or in connection with our name without special written permission. The report shall not be reproduced except in full, without written approval by our laboratory. The samples not destroyed in testing are retained a maximum of thirty days. The laboratory measurement of uncertainty for the test method is approximately less than 1 by area percent. Accredited by the National Institute of Standards and Technology, Voluntary Laboratory Accreditation Program for selected test method for asbestos. The accreditation or any reports generated by this laboratory in no way constitutes or implies product certification, approval, or endorsement by the National Institute of Standards and Technology. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. Polarized Light Microscopy may not be consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials.

CHAIN OF CUSTODY
 EMC Labs, Inc.
 9830 S. 51st St., Ste B-109
 Phoenix, AZ 85044
 (800) 362-3373 Fax (480) 893-1726

LAB#:	248289
TAT:	4-5 Day
Rec'd:	JAN 22 AM
EMC USE ONLY	

COMPANY NAME: RISKNOMICS
880 Seven Hills Drive, Ste 180
Henderson, NV 89502
 CONTACT: Andy Olcott 602-881-9665
 Phone/Fax: 480-315-1100 SCAN COC
 Email: aolcott@risknomicsllc.com & EXCEL

BILL TO: _____
 (If Different Location)

Now Accepting: **VISA - MASTERCARD** Price Quoted: \$ _____ / Sample \$ _____ / Layers

COMPLETE ITEMS 1-4: (Failure to complete any items may cause a delay in processing or analyzing your samples)

1. **TURNAROUND TIME:** [4hr rush] [8hr rush] [1-Day] [2-Day] [3-Day] [5-Day] [6-10 Day]

****Prior confirmation of turnaround time is required

****Additional charges for rush analysis (please call marketing department for pricing details)

****Laboratory analysis may be subject to delay if credit terms are not met

4-5 DAY

2. **TYPE OF ANALYSIS:** [Bulk-PLM] [Air-PCM] [Lead] [Point Count] [Fungi: AOC, W-C, Bulk, Swab, Tape]

3. **DISPOSAL INSTRUCTIONS:** [Dispose of samples at EMC] / [Return samples to me at my expense]

(If you do not indicate preference, EMC will dispose of samples 60 days from analysis.)

4. Project Name: BELLEVUE - CINCINNATI, OH
 P.O. Number: _____ Project Number: 21RN0260

EMC SAMPLE #	CLIENT SAMPLE #	DATE & TIME SAMPLED	LOCATION/MATERIAL TYPE	Samples Accepted Yes / No	AIR SAMPLE INFO / COMMENTS		
					ON	OFF	FLOW RATE
1	01	1/19-1/20/21		Y N			
				Y N			
				Y N			
				Y N			
				Y N			
121	121			Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			
				Y N			

SPECIAL INSTRUCTIONS: POSITIVE STOP

Sample Collector: (Print) CHRISTIAN MATECKI (Signature) CM

Relinquished by: CM Date/Time: 1/21/21 Received by: Diana Federico Date/Time: 1/22/21 Sam

Relinquished by: Diana Federico Date/Time: 1/22/21 9am Received by: DM Date/Time: 1-22-21-9am

Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____

** In the event of any dispute between the above parties for these services or otherwise, parties agree that jurisdiction and venue will be in Phoenix, Arizona and prevailing party will be entitled to attorney's fees and court costs.

ASBESTOS INSPECTION FIELD DATA SHEET

Page ___ of ___

Project #: 21RN JORN2260

Inspector Name and License #: Christian Matecki

Name: BLECHWOODS

Date of Inspection: 1/19-1/20/21

Location: CINCINNATI, OH

Inspector Signature: _____

Sample #	Material Description	Sample/Material Location	Qty SF/LF	Friable NF/F	Damage ND/D/SD
01	DRYWALL / JOINT COMPOUND	T.O. (1311), (1210), (OFF BRK RM CL)		NF	ND
02					
03					
04	9" GRAY W/ WHT STREAKS	1302, 1304, 1301, 1305, 1312, 1209, 1208, 1207, 1104, 1105, 1113, 1010, 1008, 1011, 1002, 1013, 1005, 1001, 901, 904, 905, 906, 912, 809, 812, 807, 813, 802, 703, 704, 705, 709, 610, 609, 612, 613, 606, 505, 506, 508, 509, 408, 409, 407, 412, 402, 401, 403, 303, 302, 300 FC STORAGE, 312, 309, 310, 209, 208, 212, 205, 204, 203, 2101, 11TH FL STOR., POOL RM CL.	GTH.		
05					
06					
07	4" BRW CONE BASE / ADHESIVE	1302, 1304, 1301, 1305, 1209, 1104, 1105, 1113, 1006, 1013, 1005, 1001, 903, 901, 904, 912, 703, 704, 705, 713, 707, 609, 612, 606, 501, 506, 409, 408, 407, 412, 402, 303, 205, 204, 203			
08					
09					
10	CERAMIC TILE, GROUT & MASTIC	11TH FL STOR., POOL RM CL			
11					
12					
13	BLACK SINIL COATING	1302			
14					
15					
16-19	POPCORN CEILING TEXTURE	T.O.		F	
17-20-22					
18-21					
23	WHT SINK COATING	1304, 1301, 1305, 1201, 1002, 806, 501, 409, 408, 407, 406, 401, 205, 1101			
24					
25					
26	FIBERGLASS PIPE WRAP	ELLEN PENTHOUSE, BATHROOMS, MAIN SHOP			
27					
28					
29	4" BLK CONE BASE / ADHESIVE	1312, 1208, 1201, 1105, 1008, 1011, 903, 906, 809, 812, 813, 806, 709, 610, 611, 613, 505, 508, 509, 401, 403, 303, 312, 309, 208, 212, 207, 1ST FL, RECREATIONAL RM			
30					
31					

ASBESTOS INSPECTION FIELD DATA SHEET

Page ___ of ___

Project #: 21RN JORN260

Inspector Name and License #: Christian Matecki

Name: BEECHWOOD

Date of Inspection: 1/19-1/20/21

Location: CINCINNATI, OH

Inspector Signature: [Signature]

Sample #	Material Description	Sample/Material Location	Qty SF/LF	Friable NF/F	Damage ND/D/SD
32	12" BEIGE W/RED W/IT ^{STREAKS} VFT / MASTIC	1311, 1201, 903, 501		NF	ND
33				}	}
34	2 ND LAYER VFT / MASTIC MASTIC				
35	4" BEIGE COLE BASE ADHESIVE	1207, 1016, 810, 709, 302, 310, 209, 161		}	}
36		1 ST 13 TH FL HALLWAYS, POOL RM, MAINT LOCKER RM			
37		MAINT OFFICES			
38	12" BEIGE W/SLIGHT RED W/IT BLOTCHES VFT / MASTIC	1206, 1201, 1620, 1015, 810, 7 TH FLOOR 2 ND OR OFF, 713, 707, 709 Cell 505, 508, 302		}	}
39					
40					
41	FIBERGLASS PIPE WRAP 4"	LAUNDRY 12 TH FL, END OF HALLWAYS			
42				}	}
43					
44		1103			
45	12" WHT W/GRAY FT / MASTIC			}	}
46					
47		1010-AR, 1011-PATCH, 913-FL, 610-PATCH, 1101-AR, 1103-PATCH 309-BUD, 209			
48	9" WHT W/BLK STREAKS VFT /			}	}
49	MASTIC				
50	Black w/ red streaks VFT / MASTIC	506 101		F	
51	Black w/ red streaks VFT / MASTIC	PUBLIC RR'S (2), COMM / REC RM, POOL RM, MAINT		}	}
52	2' X 2' WHT FISS LINES W/ PACT	LOCKER RM, MAINT OFFICES			
53	2" PIPE ELBOW / T'S	ARJUNE DROP CEILING 1 ST FL, MAINT SHOP		NF	
54				}	}
55					
56		OFFICES (3)			
57	CARPET SQ MASTIC			}	}
58					

ASBESTOS INSPECTION FIELD DATA SHEET

Page ___ of ___

 Project #: 21RN 20RN2260

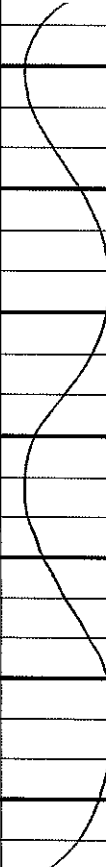
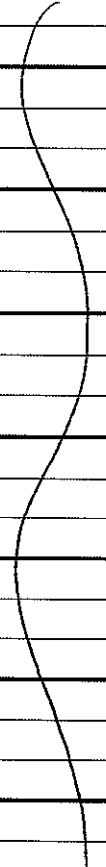
 Inspector Name and License #: Christian Matecki

 Name: BECKHWOOD

 Date of Inspection: 1/19-1/20/21

 Location: CINCINNATI, OH

 Inspector Signature: [Signature]

Sample #	Material Description	Sample/Material Location	Qty SF/LF	Friable NF/F	Damage ND/D/SD		
59 60 61	12" WHT W/GRAY FT/MASTIC	UNDER CARPET SQ		NF	ND		
62 63 64	12" BLUE/GRAY @FT/MASTIC	RECEPTION, RECEPTION LOBBY, ELEVATORS (2)					
65 66 67	4" GRAY CONE BASE/ADHESIVE	THROUGHOUT					
68 69 70	12" DK/LT GRAY FT/MASTIC	1ST-13TH FL HALLS, TRASH RMS, LAUNDRIES, POOL RM, MAINT LOCKER RM, MAINT OFFICES					
71 72 73	CMU BLOCK/MORTAR	INT WALLS T.O.					
74 75 76	CONCRETE	DECKING/WALLS					
77 78 79	12" WHT W/BLE FT/MASTIC	COMM/RECL RM					
80 81 82	12" SKY BLUE W/BLE FT/MASTIC	COMM/RECL RM					
83 84 85	2' X 2' WHT GOUGLE W/PHCT	REC OFF, 1ST FL HALL				F	

ASBESTOS INSPECTION FIELD DATA SHEET

Project #: ZIRN ZORN2260

Inspector Name and License #: Christian Matecki

Name: BLECHWOOD

Date of Inspection: 11/9-1/20/21

Location: CINCINNATI, OH

Inspector Signature: [Signature]

Sample #	Material Description	Sample/Material Location	Qty SF/LF	Friable NF/F	Damage ND/D/SD
86 - 87 -	12" BRN FT / MASTIC	LOBBY		NF	ND
88 - 89 -	12" YELLOW FT / MASTIC	LOBBY		[Large handwritten bracket spanning rows 86-109]	[Large handwritten bracket spanning rows 86-109]
90 - 91 -	12" BLUE w/ Dk BLUE FT / MASTIC	LOBBY			
92 - 93 - 94 -	4" PIPE ELBOWS	MAINT SHOP HALL, BOILER RM			
95 - 96 - 97 -	8" PIPE WRAP	BOILER RM			
98 - 99 - 100 -	8" PIPE wrap ELBOWS	BOILER RM			
101 - 102 - 103 -	12" PIPE WRAP	TRASH RM			
104 - 105 - 106 -	12" PIPE ELBOWS	TRASH RM			
107 - 108 - 109 -	24" PIPE WRAP	TRASH RM			

APPENDIX B

EMPLOYEE CREDENTIALS

From: cmatecki@risknomicsllc.com
To: aolcott@risknomicsllc.com
Subject: Fwd: Asbestos Evaluation Specialist Certification Application - Approved [ES35924]
Date: Friday, August 7, 2020 8:51:35 AM

Here is what needs to be used in lieu of a certification card.

Christian Matecki
Industrial Hygienist

[8777 E. Via de Ventura, Suite 188](#)
[Scottsdale, AZ 85258](#)
[480-315-1100](#) (o)
[602-663-2270](#) (c)
[480-948-1674](#) (f)
cmatecki@risknomicsllc.com

Begin forwarded message:

From: "asbestoslicensing@epa.ohio.gov" <asbestoslicensing@epa.ohio.gov>
Date: August 7, 2020 at 08:50:21 MST
To: "cmatecki@risknomicsllc.com" <cmatecki@risknomicsllc.com>
Subject: Asbestos Evaluation Specialist Certification Application - Approved [ES35924]

The Ohio EPA Asbestos Evaluation Specialist certification application for Christian Matecki has been approved. The certification number (ES35924) expires on 09/13/21.

Due to COVID-19, Ohio EPA staff have been restricted from accessing the Central Office building and are unable to create and mail out licenses. Please use a copy of this emailed approval as proof of your current license. Once staff are able to access the building, the mailing of approved licenses will resume.

Employers/Public may also verify certification approvals by visiting the Ohio EPA Asbestos Program website at <https://www.epa.ohio.gov/dapc/atu/asbestos#179575185-resources>. The available reports/lists are located under the "Resources" tab.

For any questions regarding the certification, please call 614-644-0226.

Ohio EPA's eBusiness Center online address: <http://ebiz.epa.ohio.gov> (PROD-B39600-ProdServer1)

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**SECTION 00 2000
INSTRUCTIONS TO BIDDERS**

PART 1

1.01 BIDDING DOCUMENTS

- A. The bidding documents are comprised of the bidding and contract requirements, the specifications, the drawings and any addenda issued prior to receipt of bids.
- B. Documents are on file and may be examined or obtained for bidding purposes as stated in Article 8 below.
- C. Bidding Documents are prepared for the use of bidders which include the General Contractor, all sub-contractors, material suppliers and all other entities who furnish or manage any portion of the work required to complete the required scope for the project.

1.02 ADDENDA DURING BIDDING

- A. Any additional information required by the bidders, revisions in the work, changes or additions, discrepancies in the bidding documents, or clarifications will be in the form of addenda written and issued by the Architect to the General Contractor as of the date of such addenda.
- B. All addenda issued prior to the time and date set for termination of bidding shall become a part of the bidding documents and bidders shall list by number and date on the form of proposal, all addenda which have been received by him prior to submittal of his bid. The lump sum proposal amount shall include all work described by all such addenda. It shall be the bidder's responsibility to determine that he has received all addenda, since no extra costs will be allowed by failure of the bidder to do so.
- C. Any bidder in doubt as to the true meaning of any part of the bidding documents. may submit, no later than ten (10) working days prior to the date set for receipt of bids, a written request to the Architect for an interpretation thereof. All interpretations of the bidding documents will be made by an addendum.
- D. No oral, telephonic, telegraphic or fax instructions or information shall be binding on the Owner, Architect, or bidder unless confirmed by an addendum.

1.03 SUBSTITUTIONS AND APPROVALS DURING BIDDING

- A. Whenever products or materials are specified as "Standards" or they are otherwise named approval of other equal quality products shall be obtained by requesting in writing and presenting for evaluation, such product or material, to the Architect, no later than ten (10) working days prior to date set for receipt of bids. Submittals a circumventing the above time frame will not be processed.
 - 1. If approval is granted, product or material will be added by addendum.
 - 2. No direct reply will be made to any requests for changes, but any requested changes approved by the Architect will be stated in an addendum issued to all prime bidders.
 - 3. Issuance of bidding documents does not constitute approval of products, materials, or subcontractors.
- B. Related requirements described elsewhere.
 - 1. Section 016300 SUBSTITUTIONS AND PRODUCT OPTIONS.

1.04 ALTERNATES AND UNIT PRICES

- A. Each bidder, in addition to the submission of his lump sum base bid, shall submit bids for any alternate bid and unit price called for; failure to submit said bids and unit prices shall be sufficient cause for the Owner to reject the bid in its entirety. Also, the Owner may, at his discretion, consider any required alternate bid in the awarding of a contract.
 - 1. Unit prices shall be the installed price unless otherwise called for and shall include overhead, profit, fees and such other costs incidental to the work described.

2. Unit prices shall be used to replace products, materials, etc. which cannot be repaired or reused as indicated on the Drawings and Specifications. Unit prices shall also be used to repair or replace products, materials, etc. which have been found unacceptable during field surveys and inspections after the contract has been awarded, but prior to performing the additional work. Unit prices shall be used for all revisions involving the addition or deletion of Contract Work.
- B. The price to be added and/or deducted shall include all labor, materials, equipment, services, facilities and all other items required to complete the work as indicated on the drawings and as specified herein. Each bidder is encouraged to submit voluntary alternates for materials, procedures and equipment that benefit the project and produce a savings to the Owner.
 - C. The Owner retains the right to include or exclude work covered by unit prices, for the sums established exercisable for the life of the contract.
 - D. All bidders shall thoroughly review and indicate for each alternate the appropriate add or deduct, no change (N/C) or not applicable (NIA). No indication will be considered as a no change. The Bidder shall be responsible for all costs associated with the Alternate as respects his contracted work regardless of the notation entered on the bid form.
 - E. Time extension alternates will have a direct effect upon schedule therefore labor and material increases should be contemplated in the extension alternates not only for the actual time extension but also for the impact on the overall schedule based upon the time of year the project is started.

1.05 BIDDER'S REPRESENTATION

- A. Each bidder, by making his bid, represents that he has read and understands the bidding documents.
- B. Each bidder shall make a careful examination of the plans and specifications, visit the site of the proposed construction and acquaint himself with all the conditions before submitting his proposal. He will be held responsible for any and all errors in his proposal resulting from his failure to make such examination. No "Request for Extras" will be entertained as a result of the bidder failing to examine the plans and specifications and inspecting the site(s) or those existing buildings when existing buildings which may be retained as part of the project. *Any discrepancies between actual field conditions and work specified in contract documents shall be brought to the written attention of the Architect during bidding or prior to bidding during initial project qualifications for bidding.*
- C. Each bidder by making his bid represents that he is properly licensed and has previous experience of the nature of the work he is bidding.
- D. Each bidder by preparing and submitting a bid represents that they have reviewed and understand all manufacturer's requirements for the complete installation of manufactured items.
 1. Manufacturer's instruction may include exact utility and service connections for specified systems, which systems may not be defined, detailed, or located by the project drawings or specifications.

1.06 PREPARATION OF BIDS

- A. Proposals should be submitted on company letterhead.
- B. Bids shall include all required documents, as noted within this Project Manual, with signatures in ink.
 1. Prices shall be stated both in figures and in writing and in the event of a discrepancy between the writing and the figures, the written amount shall govern.
- C. Any interlineation, alteration, or erasure will be grounds for rejection of the bid. Bids shall contain no recapitulation of the work to be done.

- D. Bids shall be based on the materials, construction, equipment and methods named or described in the specifications and on the drawings, and any addenda issued prior to receipt of bids.
- E. The General Contractor and each bidder to the General Contractor for the complete construction of the project must, within 7 days of receipt of request by Owner, must submit on a sheet of their company letterhead, a listing of major subcontractors, suppliers, and manufacturers furnishing and/or installing materials and products (including those who are to furnish materials or equipment fabricated to a special design) specified on this project. The list shall be complete with names, addresses, city, state and zip code.
- F. The low bidders shall be required to attend with the General Contractor and representatives of the Owner and Architect, a Pre-Award Conference. It should be noted that attendance is mandatory and the information received/confirmed at the conference will be considered in awarding a Contract.
- G. Proposal Irregularities: Any error and/or omission in the proposal form or any other irregularity as a result of negligent preparation shall not furnish cause for relief for any damages resulting therefrom nor in any way relieve the Contractor from fulfillment of all contractual obligations as provided for in the Contract Documents.

1.07 CONTRACT TIME

- A. Identify Contract Time in the Proposal Form. The completion date in the Agreement shall be the Contract Time added to the commencement date.

1.08 PLANS AND SPECIFICATIONS ON FILE

- A. Plans and specifications are on file in the Offices of the Architect, the Owner and on the Architect's File Transfer Protocol (FTP) Web site.

1.09 INTENT

- A. The intent of this Proposal request is to obtain an offer to perform work to complete the project as herein described for a Stipulated Sum contract, in accordance with the Contract Documents.

1.10 INQUIRIES/ADDENDA

- A. Direct questions to the Architect's office via email to the designated project manager.
- B. Addenda may be issued during the Proposal period. All Addenda become part of the Contract Documents. Include resultant costs in the Proposal Amount.
- C. Verbal answers are not binding on any party.

1.11 SITE EXAMINATION

- A. Examine the project site before submitting a Proposal.

1.12 PREPROPOSAL CONFERENCE

- A. A proposers conference shall be scheduled and proposers notified.
- B. All general contract proposers and suppliers are invited.
- C. Representatives of Architect will be in attendance.
- D. Information relevant to the Proposal Documents will be recorded in an Addendum, issued to Bid Document recipients.

1.13 EVIDENCE OF QUALIFICATIONS

- A. To demonstrate qualification for performing the Work of this Contract, proposers may be requested to submit written evidence of financial position, license to perform work in the State and City of Toledo.

1.14 SUBMISSION PROCEDURE

- A. Submit one copy of the executed offer on the AIA G702, G703 , signed and sealed in a closed opaque envelope, clearly identified with proposer's name, project name and Owner's name on the outside.

1.15 SALES TAX

- A. This project is subject to all applicable sales taxes.

1.16 NONDISCRIMINATION: AFFIRMATIVE ACTION

- A. The Bidder agrees that in the performance of this Agreement it shall not discriminate against any applicant for employment nor any sub-contractor or material supplier because of race, religion, sex, color, national origin, handicap, or age. The Bidder will take affirmative action to insure that applicants are employed, and that employees are treated during employment, without regard to race, religion, color, sex, national origin, handicap, or age. The Bidder shall require all contracts with its Subcontractors to contain this same provision. The Bidder and all Subcontractors shall comply with all employment and equal opportunity requirements of local, state, and federal law and regulations.

END OF SECTION

**SECTION 00 3100
AVAILABLE PROJECT INFORMATION**

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders and will be part of the Contract Documents, as follows:
- B. Site and Utility Survey: Included in the drawings, to provide location and sizes for all utilities of public record, location of and existing improvements, and detailed topographic information.
- C. Geotechnical Report: Included as part of this project specification.
 - 1. The report is available for bidders' information, but is not a warranty of subsurface conditions. The contractor is entitled to rely upon the factual information contained therein, such as locations and depths of tests or explorations made at the site and materials encountered at each location, all as of the dates made. The contractor is not entitled to rely upon the nonfactual information contained therein such as interpretations, opinions, or extrapolations of data; nor is the contractor entitled to rely upon the completeness of the information for the contractor's purposes.
 - 2. Bidders should visit the site and acquaint themselves with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but all such investigations shall be performed only under time schedules and arrangements approved in advance by the General Contractor.
 - 3. It shall be specified that all of the recommendations the Soils Engineer associated with site preparation, foundation design, and other related systems shall be incorporated by the General Contractor, whether they may have in part or in total been incorporated as part of this Project Manual or Construction Documents.
 - 4. If conditions are encountered in the field during construction which vary from the facts of this report, the "original" Soils Engineer may be contacted through the office of the Architect, immediately as necessary to examine such changed conditions in the field and make the appropriate recommendations in light of the contract documents.
 - 5. This report, by its nature, cannot reveal all conditions that exist on site. Should subsurface conditions be found to vary substantially from his report, changes in the design and construction of foundations will be made with resulting expenditures for additional engineering and architectural design to the original project scope and the original Contract Price accruing to the Owner.
- D. Hazardous Material Survey has been completed by the Owner's consultant.
 - 1. The Project Owner has retained the services of an environmental consultant under separate agreement from the Owner/Architect Agreement. The environmental consultant's project documents are included in the Project Manual and Project Drawings as a requirement of the Owner for permit and bidding purposes, and are provided only for reference purposes for construction of the project and for convenience of the bidders and contractors. The Architect takes no responsibility whatsoever for the services performed by the environmental consultant, for any breach of contract of the environmental consultant, nor for the content, accuracy, negligence, errors or omissions of the environmental consultant's project documents. Furthermore, the Architect is not in charge of the environmental consultant, and has no responsibility for coordinating the services or project documents of the environmental consultant."
 - 2. Existing hazardous materials have been identified within other consultants' documents. These documents are a part of this contract and are listed in the table of contents to this specification.

3. Each contractor shall familiarize himself with these existing conditions and shall be responsible for coordinating their work as necessary with any identified abatement work accordingly.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

3.01 OBTAINMENT OF PERMITS

- A. The following permits are known to be required and shall be obtained by the Contractor:
 1. Building Permit including all trade / subcontractor permits..

END OF SECTION

**SECTION 00 4100
BID FORM**

THE PROJECT AND THE PARTIES

1.01 TO:

- A. Cincinnati Metropolitan Housing Authority
- B. 1627 Western Ave Cincinnati, Ohio 45214

1.02 FOR: BENNETT POINT

1.03 DATE: _____ (BIDDER TO ENTER DATE)

1.04 SUBMITTED BY: (BIDDER TO ENTER NAME AND ADDRESS)

- A. Bidder's Full Name _____
 - 1. Address _____
 - 2. City, State, Zip _____

1.05 OFFER

- A. Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Bid Documents prepared by [_____] for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:
- B. _____ dollars
(\$ _____), in lawful money of the United States of America.
- C. We have included the required security deposit as required by the Instruction to Bidders.
- D. All applicable federal taxes are included and State of [_____] taxes are included in the Bid Sum.
- E. All Cash and Contingency Allowances described in Section 01 2100 - Allowances are included in the Bid Sum.

1.06 ACCEPTANCE

- A. This offer shall be open to acceptance and is irrevocable for thirty days from the bid closing date.
- B. If this bid is accepted by Owner within the time period stated above, we will:
 - 1. Execute the Agreement within seven days of receipt of Notice of Award.
 - 2. Furnish the required bonds within seven days of receipt of Notice of Award.
 - 3. Commence work within seven days after written Notice to Proceed of this bid.
- C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.
- D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.07 CONTRACT TIME

- A. If this Bid is accepted, we will:
- B. Complete the Work in _____ calendar weeks from Notice to Proceed. (Bidder to enter number of weeks.)

1.08 UNIT PRICES

- A. The following are Unit Prices for specific portions of the Work as listed. The following is the list of Unit Prices:
- B. ITEM DESCRIPTION - UNIT QUANTITY - UNIT PRICE - ITEM VALUE
- C. [] - [] - [] - \$

1.09 CHANGES TO THE WORK

- A. When Architect establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, our percentage fee will be:
 - 1. _____ percent overhead and profit on the net cost of our own Work;
 - 2. _____ percent on the cost of work done by any Subcontractor.
- B. On work deleted from the Contract, our credit to Owner shall be Architect-approved net cost plus _____ of the overhead and profit percentage noted above.

1.10 ADDENDA

- A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.
 - 1. Addendum # _____ Dated _____.

1.11 BID FORM SUPPLEMENTS

- A. The following information is included with Bid submission:
 - 1. Subcontractors: [], [], [].
 - 2. Unit Prices: [], [], [].
 - 3. Alternates: [], [], [].

1.12 BID FORM SIGNATURE(S)

- A. The Corporate Seal of
- B. _____
- C. (Bidder - print the full name of your firm)
- D. was hereunto affixed in the presence of:
- E. _____
- F. (Authorized signing officer, Title)
- G. (Seal)
- H. _____
- I. (Authorized signing officer, Title)

1.13 IF THE BID IS A JOINT VENTURE OR PARTNERSHIP, ADD ADDITIONAL FORMS OF EXECUTION FOR EACH MEMBER OF THE JOINT VENTURE IN THE APPROPRIATE FORM OR FORMS AS ABOVE.

END OF SECTION

**SECTION 00 4322
UNIT PRICES FORM**

PARTICULARS

1.01 (BIDDER) _____

1.02 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

1.03 THE FOLLOWING ARE UNIT PRICES FOR SPECIFIC PORTIONS OF THE WORK AS LISTED, AND ARE APPLICABLE TO AUTHORIZED VARIATIONS FROM THE CONTRACT DOCUMENTS.

UNIT PRICE LIST

2.01 ITEM DESCRIPTION UNIT QUANTITY UNIT VALUE

END OF SECTION

**SECTION 00 4323
ALTERNATES FORM**

PARTICULARS

**1.01 THE FOLLOWING IS THE LIST OF ALTERNATES REFERENCED IN THE BID
SUBMITTED BY:**

1.02 (BIDDER) _____

1.03 TO (OWNER): [_____]

1.04 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

ALTERNATES LIST

END OF SECTION

**SECTION 00 4335
PROPOSED ELECTRICAL PRODUCTS FORM**

PARTICULARS

1.01 THE FOLLOWING IS THE LIST OF SUPPLEMENTARY ELECTRICAL INFORMATION REFERENCED IN THE BID SUBMITTED BY:

1.02 BIDDER) _____

1.03 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

LIST

COMPONENT OR ITEM MANUFACTURER

END OF SECTION

**SECTION 00 5200
AGREEMENT FORM**

PART 1 GENERAL

1.01 FORM OF AGREEMENT

1.02 THE AGREEMENT TO BE EXECUTED IS ATTACHED FOLLOWING THIS PAGE.

1.03 THE BIDDER TO WHOM AN AWARD OF THE CONTRACT IS MADE SHALL EXECUTE AN AGREEMENT DIRECTLY WITH THE OWNER USING AIA DOCUMENT A101, STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR, 2007 EDITION, AS PUBLISHED BY THE AMERICAN INSTITUTE OF ARCHITECTS, WHERE THE BASIS OF PAYMENT IS A STIPULATED SUM.

1.04 COPY OF THE CONTRACT FORM IS ON FILE IN THE ARCHITECT'S OFFICE AND AVAILABLE UPON REQUEST THROUGH THE ARCHITECT, IF NOT OTHERWISE BOUND IMMEDIATELY FOLLOWING THIS PAGE OF THE PROJECT MANUAL.

1.05 RELATED REQUIREMENTS

- A. Section 00 7200 - General Conditions.
- B. Section 00 7300 - Supplementary Conditions.
- C. Section 01 4216 - Definitions.
- D. Documents used for project processing shall be American Institute of Architects Documents, latest editions, and referenced by the following document numbers.
- E. When alternate Owner/Contractor Agreement forms are adopted for the project by the Owner, other than Standard American Institute of Architect Document forms, the Owner shall include AIA Document A201-2007 General Conditions to the Contract for Construction, and other applicable Supplementary Conditions.

1.06 FORMS

- A. Use the following form for the specified purpose unless otherwise indicated elsewhere in the Contract Documents.
- B. Clarification and Modification Forms
 - 1. Supplementary Instruction Form: AIA G710
 - 2. Construction Change Directive Form: AIA G714
 - 3. Contract Change Order Form: AIA G701
 - 4. HUD Request for Construction Changes form 92437
- C. Closeout Forms:
 - 1. Certificate of Substantial Completion Form: AIA G704
 - 2. HUD Permission to Occupy 92485
- D. Certificates of Payments
 - 1. Application and Certificate for Payment Form: AIA G702
 - 2. Continuation Sheet for AIA G702: AIA G703
 - 3. HUD Contractor's Requisition 92448

1.07 REFERENCE STANDARDS

- A. AIA G704 - Certificate of Substantial Completion; 2000
- B. AIA G710 - Architect's Supplemental Instructions; 1992
- C. AIA G704 - Construction Change Directive; 2007

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 00 7000
GENERAL CONDITIONS**

PART 1

1.01 THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AIA A201 (2007) ARE HEREBY MADE A PART OF THE CONTRACT DOCUMENTS, EXCEPT AS THEY MAY BE MODIFIED BY SECTION 00800 SUPPLEMENTARY CONDITIONS AND THE SPECIFIC PROVISIONS OF THESE DOCUMENTS.

1.02 REFER TO: AIA A201 (2007) PAGES 1 THRU 43.

END OF SECTION

**SECTION 00 7100
CONTRACTING DEFINITIONS**

PART 1 GENERAL

1.01 APPLICABILITY:

- A. These definitions are integral to the Agreement, for the portions of the work which are managed throughout the process of construction, or in the case of 'design assist' by the Contractor in conjunction with the Owner, the Architect and Project Engineers.

1.02 DEFINITIONS - DESIGN-BUILD DOCUMENTS

- A. Contract Documents: As defined in the Conditions of the Contract and as follows:
 - 1. At the time of execution of the Agreement, the Contract Documents consist of the following:
 - a. The Agreement and Conditions of the Contract, and other documents listed on the Table of Contents under the heading Contracting Requirements.
 - b. The Proposal and Proposal Exhibits, except for provisions that contradict the requirements of the Conceptual Documents and that are not specifically accepted by the Owner by means of written Modification prior to execution of the Agreement.
 - 2. From time to time after execution of the Agreement, upon approval by the Owner, the following types of documents will be incorporated into the Contract Documents:
 - a. Drawings and other documents documenting the design.
 - b. Construction drawings and specifications detailing the execution of the design. All drawings, plans, specifications, other instructions including manufacturer's requirements for installation and any other documents which provides direction for completing the work schedules for the completion of the project.
- B. Project Program: The Owner's requirements for size, arrangement, organization, and location of functional spaces, description of space functions, identification of fittings, equipment, and furnishings, description of the physical and environmental requirements for each space, together with a description of the image, goals, or "mission" of the project.
- C. Proposal: The Proposal Form and Exhibits, which comprise the information prepared by the prospective Design-Builder to show their method of complying with the Conceptual Documents.

1.03 DEFINITIONS - TIME PERIODS AND MILESTONE DATES

- A. Proposal Period: The time period during which prospective Proposers prepare their Proposals.
 - 1. Substantiation specified to occur during the Proposal period are intended to accompany the Proposal.
- B. Preliminary Design: The time period during which the design criteria are finalized and preliminary drawings and written descriptions are prepared to illustrate the proposed design of the work or a portion of the work to the Owner, as described in the Conditions of the Contract.
- C. Design Development: The time period during which the form, arrangement, size, and materials of the work or a portion of the work are determined as described in the Conditions of the Contract.
- D. Construction Documents: The time period during which process working drawings, specifications, and other documents describing the work or a portion of the work are prepared in sufficient detail to allow accurate and complete construction.

- E. Construction: The time period from the beginning of work on the project site until final payment as defined in the Conditions of the Contract..
- F. Substantial Completion: The date as defined in the Conditions of the Contract. Date of Substantial Completion is the due date for the following:
 - 1. Design-Builder or Architect's complete punchlist of items to be completed.
 - 2. Owner's complete punchlist of items to be completed.
 - 3. Compliance with requirements of governing authorities, for submittals, inspections, and permits.
 - 4. Compliance with Owner's requirements for access to areas occupied by the Owner.
 - 5. Final cleaning.
 - 6. Maintenance manuals.
 - 7. Warranties.
 - 8. Spare parts and extra materials.
 - 9. Maintenance supplies and tools.
 - 10. Project record documents.
 - 11. Final site survey.
- G. Closeout: The time period during which all details of both construction and commissioning are completed.
 - 1. The Closeout period is the time from Date of Substantial Completion until final payment, both as defined by the Conditions of the Contract.
 - 2. Before and during the Closeout period, the Owner will ascertain whether the completed project complies with the the Contract Documents.
 - 3. Contractor is responsible for operation and maintenance of the project until the end of the Closeout period; except for those areas the owner has moved into. Once the owner has moved into an area the contractor's responsibilities for operation and maintenance of that area will decrease.
 - 4. Training of Owner's personnel in operation and maintenance occurs during the Closeout period, unless specifically indicated otherwise for certain items.
- H. Occupancy: The time period during which the project is occupied for its intended purpose.
 - 1. The Occupancy period begins at Date of Substantial Completion, as defined by the Conditions of the Contract.
 - 2. Move-in will occur before the end of the Closeout period.
 - 3. Design-Builder is responsible for operation and maintenance of the project until the end of the Closeout period.
- I. Correction Period: The time period defined by the Conditions of the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 00 8000
SUPPLEMENTARY CONDITIONS**

PART 1

1.01 SCOPE

- A. Description
1. The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction," AIA Document A201, 2007 edition. Where any article of the General Conditions is modified or any paragraph, subparagraph or clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that article, paragraph, subparagraph or clause shall remain in effect.

PART 2

2.01 SUPPLEMENTS

- A. Article 1 - General Provisions
1. Add the following clause to subparagraph 1.2.3:
 - a. 1.2.3.1 The specifications are, in part, of the brief or "streamlined" type and include incomplete sentences. Omissions of words or phrases such as "The Contractor shall", "as noted on the drawings", "according to the drawings", "a", "an", "the" and "all" are intentional.
 - 1) Omitted words or phrases shall be supplied by inference in same manner as they are when "note" occurs on the drawings. Words "shall" or "shall be" shall be supplied by inference where a colon(:) is used within sentence or phrases. Words "as per" shall mean "in accordance with". Words "provide" and "work" shall mean furnish, install and connect up complete, in operative conditions and use, all materials, equipment, apparatus and required appurtenances of the particular item to which it has reference. Whenever words "approved" "satisfactory", "directed", "submitted", "inspected", or similar words or phrases are used, it shall be assumed that the word "Architect" follows the verb as the object of the clause, such as "approved by the Architect" and "submitted to the Architect". Where a manufacturer's name is mentioned, words "as manufactured by" or "as made by" shall be understood.
 2. Add the following clause to subparagraph 1.6.1:
 - a. Reproduction of any portion of the Architect's Construction Documents for use as Submittals for Shop Drawings is not acceptable.
- B. Article 3 – Contractor
1. Add the following clause to subparagraph 3.3.1:
 - a. 3.3.1.1 The Contractor shall review any specified construction or installation procedure, including those recommended by Manufacturers and shall advise the Architect:
 - 1) the specified procedure deviates from good construction practice
 - 2) following the procedure, will affect any warranties, including the Contractor's general warranty.
 - 3) any objections that the Contractor may have to the procedure
 - 4) the Contractor proposes any alternative procedure which the Contractor is willing to warrant.
 2. Add the following subparagraphs to paragraph 3.4:
 - a. 3.4.3 Products are generally specified by ASTM or other referenced standard, and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product or manufacturer as specified as being equally acceptable. The

Contractor has the option of using any product and manufacturer combination listed. (When only one product and manufacturer is specified, this is the basis of the Contract, without substitution or exception).

3. Add the following clause to subparagraph 3.4.5:
 - a. 3.4.5.1 The Contractor shall disclose the existence and extent of any financial interest, whether direct or indirect, he has in Subcontractors or Material Suppliers which he may propose for this project.
 4. 3.4.6 Substitutions will not be considered if:
 - a. they are indicated or implied on shop drawings submissions without the formal request required in subparagraph 3.4.4.
 - b. for their implementation they require a substantial revision of the Contract Documents in order to accommodate their use.
 - c. They appear to be merely for the decrease in expenditures on behalf of the Contractor without a corresponding reduction in costs to the Owner.
 5. 3.4.7 All Contractors and subcontractors employed on the work shall be required to conform to the governing labor laws and the various acts amendatory thereto, and all other laws, ordinances and legal requirements applicable thereto.
 6. 3.4.8 The Contractor or his subcontractors shall not discriminate in hiring or any matter of employment by reason of sex, race, color, religion, ancestry, or national origin. Submission of a bid on this project is implied acceptance of the inclusion of this clause and all Contract Documents.
 7. Add the following clauses to subparagraph 3.18.1:
 - a. 3.18.1.1 The Contractor is solely responsible for all citations and penalties arising out of, or resulting from, the performance of the work under his Contract.
 - b. The Contractor shall indemnify and hold harmless the Owner, the Architect, and their agents and employees from and against all claims, damages, losses and expenses, including attorney's fees, arising out of such Occupational Safety and Health Act violations and other applicable ordinances, rules, and regulations outlined in Article 10.
- C. Article 4 - Administration of the Contract
1. Arbitration: Delete all references to arbitration from the General Conditions.
 2. Add the following clause to subparagraph 4.2.4:
 - a. 4.2.4.1 Any direct communication between Owner and Contractor that affects the performance or administration of the Contract shall be made or confirmed in writing, with copies to the Architect, and any such communications that represent a modification of the Contract requirements shall be documented appropriately.
 3. 4.2.4.2 Any communications among the Architect and Subcontractors shall be confirmed in writing to the Contractor.
- D. Article 5 – Subcontractors
1. "5.2.1 (Delete the first sentence of this paragraph and substitute the following.) Each bidder, within 20 calendar days after award of the Contract, shall submit on a sheet of their Company Letterhead, for review by the Owner and Architect, a complete list of major subcontractors and manufacturers furnishing and/or installing materials and products specified on this project. The list shall be complete with names, addresses, city, state and zip code."
 2. Prior to commencing construction a Pre-Construction Conference shall be held.
- E. Article 7 - Changes in the Work
1. In the first sentence of subparagraph 7.3.6, delete the words "a reasonable allowance for overhead, and profit" and substitute "an allowance for profit in accordance with the schedule set forth in subparagraphs 7.3.10".
 2. Add the following subparagraph to paragraph 7.3:

- a. 7.3.10 In subparagraphs 7.3.3 and 7.3.6 the allowance for profit included in the total cost to the Owner, shall be based on the following schedule:
 - 1) For the Contractor, for work performed by the Contractor's own forces, the percentage equal to the current percentage for the Contractor's overhead and profit.
 - 2) For the Contractor, for work performed by his subcontractor, five percent (5%) of the amount due the subcontractor.
 - 3) For the Contractor, for materials supplied by his material supplier, five percent (5%) of the amount due the material supplier.
 - 4) Cost to which profit is to be applied shall be determined in accordance with subparagraphs 7.3.6 and 7.3.7.
 - 5) In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed above. Separate labor breakdowns shall be submitted for foremen, mechanics, apprentices and laborers. Where major cost items are subcontracts, they shall be itemized also. In no case will a change involving over \$500.00 be approved without such itemization
 - 6) For deduct Change Orders not signed by the Contractor, the Architect will hold funds equal to the deduct until signed.

F. Article 8 – Time

1. Revise subparagraph 8.1.2 to read as follows:
 - a. "The date of commencement of the work is the date established in a notice to proceed. If there is no notice to proceed, it shall be the date established in the Agreement. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible."
2. Add the following subparagraphs to paragraph 8.2:
 - a. 8.2.4 Each prime Contractor, subcontractor, and/or material company shall furnish sufficient labor forces, construction plant and equipment, temporary heat, enclosures, etc., required for their work and protection unless specified elsewhere, and shall work such hours, including night shifts and overtime operations as may be necessary to insure the prosecution of the work in accordance with the approved current progress schedule. If, in the opinion of the Architect, the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve his progress without additional cost to the Owner. Failure of the Contractor to comply with the requirements of the Architect under this provision shall be grounds for determination by the Architect that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination, the Owner shall have the right, without limiting any other right he may have to either not approve reduction of retainage or to terminate the Contractor's right to proceed with the work or any separable part thereof.
 - b. 8.2.5 Timely performance is an expressed condition of the contract and any delay in the Contractor's performance may excuse the Owner from his obligation to perform. Failure to abide by the time condition may be treated as a breach of contract.
3. Delete subparagraph 8.3.2 and replace with the following:
 - a. 8.3.2 The Contractor agrees that whether or not any delay shall be the basis for a modification of time, he shall have no claim against the Owner or Architect for an increase in the contract price, nor a claim against the Owner or Architect for a payment or allowance of any kind for damage, loss or expense resulting from delays, or acceleration, or any other modification of

schedule; nor shall the Contractor have any claim for damage, loss or expense resulting from interruptions to or suspension of, his work to enable other Contractors to perform their work. The only remedy available to the Contractor shall be a modification of time.

G. Article 9 - Payments and Completion

1. Revise clause 9.3.1.1 to read as follows:
 - a. "Such applications may not include requests for payment on account of changes ...".
2. Add the following to clause 9.3.1.1:
 - a. Such applications shall not include Change Orders that have been issued but have not been fully executed.
3. Add the following subparagraphs to paragraph 9.8.2:
 - a. 9.8.2.1 If the initial inspection requested by the Contractor to establish Substantial Completion determines the Project is not substantially complete, the Contractor shall pay for additional re-inspections by the Architect, at no expense to the Owner.
4. In subparagraph 9.8.3, add the following:
 - a. "The payment shall be sufficient to increase the total payments to ninety-five percent (95%) of the contract sum, less such amounts as the Architect shall determine for all incomplete work and unsettled claims."

H. Article 10 - Protection of Persons and Property

1. Add the following clauses to subparagraph 10.1.1:
 - a. 10.1.1.1 If the Owner believes in good faith that the Contractor is not fulfilling his responsibilities under Article 10 of the General Conditions, the owner may, but is not required, to order the Contractor to immediately cease work until such time as the Contractor comes within compliance. If the Owner believes in good faith that the Contractor has failed to come within compliance within seven (7) days of receiving the notice to cease work, the Owner may terminate the Contract obligations under Article 14 of the General Conditions. Nothing contained herein shall be deemed to shift the responsibility of the safety of persons and property from the Contractor to any other person or entity, and the Owner and the Architect specifically disavow same.
 - b. 10.1.1.2 The Contractor shall indemnify and hold harmless the Owner and Architect for any claim or demand made against either or both which arises out of an actual or claimed violation of Article 10, including all reasonable attorneys' fees and costs of litigation.
 - c. 10.1.1.3 The Owner reserves the right to hire an independent third party safety consultant to review and advise on all related safety activities pursuant to the job. This does not relieve in any manner any contractor the specific duty for compliance in regard to any local, state, or federal regulation pertaining to safety on the job-site. Any fines generated as a result of a contractor's non-compliance with a local, state or federal safety regulation shall be the responsibility of the contractor. Any fine issued to the owner (or any party other than the responsible contractor) as a result of a contractor's non-compliance shall be the responsibility of the contractor.
2. Add the following clauses to subparagraph 10.2.1:
 - a. 10.2.1.4 All work, materials, apparatus and fixtures, which may be caused by weather (rain, winds, storms, frost and heat).
 - b. 10.2.1.5 Excavated banks, trenches and the building from damage from rainwater, spring water, groundwater, backing up of drains or sewers and all other water admitted to the work by his operation. He shall provide all pumps and other equipment and enclosures to provide this protection.
3. Revise Subparagraph 10.2.5 as follows:

- a. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Clauses 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Clauses 10.2.1.2, 10.2.1.3 and 10.2.1.4. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.18.
- I. Article 11 - Insurance and Bonds
- 1. Prior to the commencement of any work and prior to the performance of any service, the Contractor shall procure and pay for the following insurance coverages, and he shall maintain them in force after his work is completed and accepted for final payment and throughout the one (1) year guarantee period. The insurers and policies shall be subject to the Owner's approval.
 - 2. The types and amounts of insurance to be provided for by the Contractor shall be as follows:
 - a. Workmen's Compensation
 - 1) Statutory Workmen's Compensation and Occupational Disease Insurance with all elective employments covered and all excluded employments covered on a voluntary basis where permissible,
 - 2) The Workmen's Compensation policy shall contain the following endorsement, unless specifically prohibited by compensation insurance authorities having jurisdiction:
 - (a) "Whereas, Contractor may undertake to perform work for the Owner; and, whereas, said Owner may exercise some degree of jurisdiction or control over the employees of Contractor engaged in such work, it is agreed that, subject to the conditions and limitations of this policy, said Owner is named as an additional insured employer under this policy, but only as respects employees of Contractor whose names appear on the payroll records of Contractor while performing such work for said company."
 - b. Bodily Injury and Property Damage Liability
 - 1) The liability policy shall be on a comprehensive liability form and shall include, but not be limited to, coverage for all operations of the Contractor, including automobile, premises, contractual liability, completed operations liability, personal injury liability and coverage as respects the explosion, collapse and underground hazards.
 - 2) The Contractor shall effect and maintain insurance covering himself or his agents, the Owner or its assignee and the Architect/Engineer against all claims, demands or actions arising under the Ohio Workmen's Compensation Law against all other claims, demands or actions for injury to, or death of, persons and damage to property, and will furnish the Owner with certificates showing the following coverages in complete satisfaction to the Owner.
 - 3) Worker's Compensation Insurance, Occupational Disease Insurance and Employer's Liability Insurance for all employees engaged in the work under this agreement.
 - (a) Employer's Liability \$500,000 each Accident, Disease Aggregate
 - 4) Commercial General Liability Insurance, including Contractor's Protective Liability, Completed Operations, Blanket Contractual and Personal Injury Liability, and Coverage as Respects the Explosion, Collapse, and Underground Hazards:
 - (a) Each Occurrence \$1,000,000

- (b) Personal Injury \$1,000,000
 - (c) General Aggregate \$2,000,000
 - (d) Products/Completed Operations
 - (e) Aggregate \$2,000,000
 - (f) Automobile Liability \$1,000,000 Occurrence
 - (g) Excess Liability \$5,000,000 Each occurrence
 - (h) \$5,000,000 Aggregate
 - (i) The combination of Primary and Excess Limits shall meet and/or exceed the above required limits. The insurance coverage provided should meet the exposures relating to the type of work performed.
- c. Automobile Insurance: Contractors shall maintain a comprehensive automobile form of insurance with minimum limits of \$1,000,000 combined single limit applying to bodily injury and property damage liability. The automobile insurance must include coverage for all owned, nonowned and hired automobiles.
 - d. Umbrella Liability Insurance: An umbrella policy shall be furnished in the minimum amount of \$5,000,000. The above underlying primary limits of liability for both comprehensive general liability and comprehensive automobile liability may be reduced only if an excess umbrella policy is obtained with a minimum limit of \$5,000,000 and then only to the extent to the minimum required for primary coverage under such excess contract.
 - e. Aircraft Liability Insurance: If any aircraft is to be used by the Contractor in connection with this contract either as a conveyance to and from the location of the job site or for use in the course of construction, liability insurance in the amounts acceptable to the Owner shall be obtained by the Contractor and this liability coverage shall be shown on the insurance certificate. If the Contractor will not be using aircraft as described above, then the Contractor shall have the following statement on his certificate of insurance:
 - f. Proof of Carriage of Insurance: The Contractor shall not commence work under this contract until he has obtained all insurance required, as specified herein, and has filed with the Architect three (3) certificates of insurance described herein, evidencing the carriage of insurance and the requisite amounts placed with satisfactory carriers licensed in the State of Insert State here, and countersigned by a resident Insert State here agent. Should any coverage approach expiration during the contract period, it shall be renewed prior to its expiration and certificates again filed with the Architect. Said certificates are to contain the following:
 - 1) "It is hereby agreed that the Owner shall be notified ten (10) days prior to cancellation of any insurance, material alteration and/or election not to renew."
 - 2) All insurance shall be maintained in full force and effect until the contract has been fully and completely performed.
 - g. Owner's Insurance
 - 1) Owner's Liability Insurance: The Owner shall be responsible for and at their option may maintain such insurance that will protect them from their contingent liability to others for damages because of bodily injury, including theft, and property damages which may arise from operations under any contracts that may be awarded as specified herein.
 - 2) Property/Builder's Risk Insurance: The Owner shall maintain "All Risk" (Builder's Risk Completed Value Form Insurance) insurance which shall include, but not be limited to, fire, lightning, extended coverage perils, vandalism and malicious mischief, collapse, water damage from bursting pipes, and theft of building materials from the job site upon the renovation/remodeling which is the subject of this contract. Coverage shall include items of labor and materials connected therewith whether

in or within 100 feet of the structure insured, materials in place or to be used as part of the permanent construction, including surplus materials, protective fences, bridges, or temporary structures, miscellaneous materials and supplies incidental to the work, and such scaffolding, staging, towers, forms, and equipment as are not owned or rented by the Contractor, the cost of which is included in the cost of the work. The policy shall insure the Owner and shall also include the interest of the Contractor during course of construction until completed and accepted by the Owner. Coverage shall not be voided by partial occupancy until the work is completed and accepted by the Owner.

- 3) Loss, if any, is to be adjusted both with and payable to the Owner as trustees for the insureds as their interest may appear, except in such cases as may require payment of all or a portion of such insurance to be made to the mortgagee, as his interest may appear. Any deductibles shall be paid by the Owner.
- 4) Exclusions: The insurance does not cover any tools owned by mechanics, any tools, equipment, scaffolding, staging, towers, and forms owned or rented by the Contractor, the capital value of which is not included in the cost of the work, or Contractor's sheds or other structures that are erected for housing the workmen.

J. Article 13 - Miscellaneous Provisions

1. Delete subparagraph 13.5.5 and substitute the following:
 - a. "All equipment shall be inspected and tested under operating conditions. The Architect and/or Owner reserve the right to be present at said testing. Contractor shall give the Architect and Owner at least thirty-six (36) hours advance notice by facsimile prior to scheduling said tests and operations. If inspection or tests show defects, they shall be corrected and inspections and tests repeated until proven satisfactory. Neither the observations of the Architect in administration of the Contract, nor inspections, tests or approvals by persons other than the Contractor, shall relieve the Contractor from obligations to perform the Work in accordance with the Contract Documents."
2. Add the following paragraphs:
 - a. "13.8 NON-DISCRIMINATION
 - b. "13.8.1 During the performance of this Contract, the Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, creed, sex or national origin. The Contractor will take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, creed, sex, or national origin. Such actions shall include, but not to be limited to, the following: employment, up-grading, demotion or transfer, recruitment advertising, layoffs 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 setting forth the provisions of this clause.
 - c. "A13.8.2 The Contractor will, 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, creed, sex, or national origin.@"
 - d. A13.8.3 The Contractor will send to each labor union or representative of workers with which the Contractor has a collective bargaining agreement or other contract or understanding, a notice to be provided by or at the direction of the federal government, advising the labor union or workers' representative of the Contractor's commitments under the Contract and shall post copies of

the notice in conspicuous places available to employees and applicants for employment. @

- e. A13.8.4 The Contractor will include the provisions of this clause in every subcontract or purchase order entered into in connection with the Work and will require subcontractors to include such provisions in any sub-subcontracts or purchase orders entered into in connection with the Work. @
 - f. A13.8.5 (HUD projects only) The Contractor and all subcontractors will comply with all provisions of Executive Order 11246 (30 FR 12319, September 28, 1965), as amended, the rules, regulations, and relevant orders of the Secretary of Labor, and the regulations of HUD. @
- K. Article 14 - Termination or Suspension of the Contract
- 1. Add the following clause to 14.2.1:
 - a. 14.2.1.5 the Contractor is adjudged a bankrupt.
- L. Article 15 - Additional Articles
- 1. Add the following clauses:
 - a. 15.1 The General Contractor shall be responsible to contact the Architect as necessary to determine Sales Tax requirements for the project. Sale Taxes shall be included in all presentations of project costs, unless otherwise specified by NCR that the project is to be treated Atax exempt. @
 - b. 15.2.3 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 organizations or workers' representative of the Contractor's commitments to hiring low-income persons in accordance with the Regulations 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 hiring preference and shall set forth the minimum number of job titles subject to hire, the availability of apprenticeship and training positions, the qualification for each, the name and location of the person(s) taking applications for each of the positions, and the anticipated date the work will begin.
 - c. 15.2.4 The Contractor agrees to include the low-income hiring requirement in every subcontract for Work in connection with the Project and agrees to take appropriate action, as provided in an application provision of the subcontract or in the Regulations upon a finding that the subcontractor is in violation of the low-income hiring requirements set forth in the Regulations. 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.
 - d. 15.2.5 The Contractor hereby certifies 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 employment opportunities must be directed, were not filled to circumvent the Contractor's obligations to comply with the Regulations.
 - e. 15.2.6 The Contractor's noncompliance with the Regulations may result in sanctions, termination of this Contract for default, and debarment or suspension from future contracts and from future HUD-assisted contracts.
 - f. 15.2.7 The Contractor agrees to abide by the requirements of Section 3 and the Regulations and will also cause such requirements to be inserted in any subcontracts entered into with third parties for covered by this Contract.
 - g. 15.3 PREVAILING WAGE CLAUSE (HUD PROJECTS ONLY)
 - h. 15.3.1 The Contractor and all subcontractors shall pay all laborers and mechanics employed or working upon the site of the Work, unconditionally and not less often than once a week, the full amount of wages and bona fide fringe benefits due at the time of payment, computed at rates not less than

those contained in the wage determination of the Secretary of Labor in effect on the date of the Contract and attached hereto. The Contractor shall provide the appropriate wage determination (including any additional classification and wage rates conformed under 29 C.F.R./Part 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. The Contractor will follow HUD and Department of Labor guidelines in determining the job classifications, wages, and fringe benefits that apply and in making timely payments to employees.

- i. 15.3.2 The Contractor will maintain payrolls and basic records relating to payrolls during the course of the Work and preserve for a period of three years thereafter for all laborers and mechanics working at the site of the Work. 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 cost anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in the Section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid.
- j. 15.3.3 The Contractor agrees to include the provisions of this clause in every subcontract entered into in connection with the Work and to require each subcontractor to include such provisions in any sub-subcontracts made in connection with the Work.
- k. 15.3.4 The Contractor and all subcontractors will comply with all regulations of HUD and of the Department of Labor that are applicable to the Project with respect to the payment of wages and fringe benefits under the Davis-Bacon Act.
- l. Liquidated Damages shall be as set forth in the Owner/Contractor Contract HUD 92442M.

M. Correlation, Intent and Interpretation

1. The specifications, drawings and directions furnished by the Architect are intended to cooperate and agree. The drawings and specifications shall be interpreted by the Architect according to spirit and intent of same, without any extra charge whatsoever, and if any discrepancies or variations appear between any of the drawings or specifications, such discrepancies shall be interpreted by the Architect.
2. Anything shown on the plans and not mentioned in the specifications or vice versa must be furnished by the Contractor without extra compensation. Furthermore, if any materials or work is required which is absolutely necessary to carry out the full meaning and intent of the plans and specifications, the Contractor hereby agrees to consider and allow for the same as fully as if they are so noted and to perform the work without extra charge or claim for extra compensations.

N. Drawings

1. No dimensions are to be presumed by the Contractor, nor are the drawings to be scaled on the job. If there appears to be a variation between the written dimension and the scale of the drawing, the written dimension will govern in all cases.

O. Progress Schedule

1. The General Contractor shall provide a progress schedule (such as bar chart) for Architect's review and shall update same as required throughout the course of the project. This schedule shall show the order in which the Contractor proposes to perform the work and dates contemplated for starting and completing the work within the Time of Completion specified in the Notice to Proceed. The information provided on the form shall be realistic and consistent with the Schedule of Amounts for Contract Payments.

- P. Progress Meeting
1. The Owner may request at will that all principals of performing Contractors be gathered in meeting for the purpose of discussion relating to work progress, coordination of operation delays, clarification, time schedules, etc. Notification will be issued by authorized person and attendance will be mandatory one (1) per week (maximum). Contractor shall conduct scheduled progress meetings at monthly intervals. Coordinate dates of meetings with review of payment requests. Attendees shall include: HUD Inspector (if applicable), Project Manager, Project Superintendent, Inspecting Architect, Owner representative, subcontractors, and other concerned parties.
- Q. Field Measurements
1. The Contractor shall obtain his own lines and/or grades, and shall assume all responsibility for the accuracy of same. He shall reconcile all measurements and conditions on the site of proposed work.
- R. Alternate Construction
1. In case quantitative alternates are accepted, the substitute materials and/or items shall be used so that the resulting design and arrangement shall resemble that in the base bid as nearly as possible.
- S. Adjustment to Building Conditions
1. The locations and arrangement of the various parts of the installations are indicated on the drawings and the parts shall be installed as approximately shown thereon. Any change necessary to pass immovable obstructions shall be made by the Contractor without additional cost. Under no circumstances shall any sizes be decreased or radical changes be made in any part of the installation without the written consent of the Architect.
- T. Codes
1. All work on this project shall be in accordance with all applicable federal, state and local codes and regulations having jurisdiction over this project.
- U. Record Drawings/Operation & Maintenance Manual
1. At the completion of the project, each Contractor shall submit two (2) sets of plans and specifications which have been marked in red to indicate all changes made documenting construction which deviates from the original contract documents. These shall constitute the As-built drawings. The Contractor shall furnish a minimum of two (2) complete hard-copy sets and two (2) complete electronic (CD) sets of operation/maintenance manuals to the Architect for Owner's use, the Contractor's files, and Architect's files. Each subcontractor shall cooperate with the General Contractor and provide full information (including complete cut sheets) of all equipment, fixtures, etc., included within their scope of work.
- V. Schedule of Values
1. Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to the various portions of the work, supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used only as a basis for the Contractor's applications for payment.
- W. Barricades and Warnings
1. Contractor shall construct and maintain all barricades as required to provide protection to the public and to the work. Danger signals, warning signs, red flags, lanterns and lights shall be provided and maintained as needed. All the above shall comply with all applicable codes and ordinances.
- X. Construction Signs
1. Within ten (10) days of commencing work, the General Contractor will furnish and erect one (1) construction sign at the site located as directed by the Architect. The

sign shall be 8'-0" x 6'-0" with the design and layout as directed by the Architect. The layout will be issued to the Contractor at the pre-construction conference. No other sign or advertising device will be permitted on the premises except upon the express approval of the Architect and subject to mutual agreement with the Owner concerning extent and arrangement of such device.

Y. "Or Equal"

1. Where phrase "or equal", or "or equal as approved by the Architect" or "or Architect approved equal" occurs in the Contract Documents, do not assume that material, equipment or methods will be approved as equal by the Architect unless the item has been approved for this work in writing by the Architect.

Z. Colors

1. Unless the precise color is specifically described in the Contract Documents, whenever a choice of color is desired, submit accurate color charts and samples to the Architect for review and selection.

AA. Availability of Specified Items

1. Verify, prior to bidding, that all specified items will be available in the time table required for orderly and timely installation so as not to impede the progress of the work.
2. In the event specified item or items will not be available, so notify the Architect a minimum of ten (10) working days prior to receipt of bids.

BB. Project Superintendent

1. The project superintendent shall be satisfactory to the Owner; thus, the Contractor shall assign a superintendent only after the Owner has reviewed the superintendent's qualifications, is aware of who the superintendent will be and approves of such. A change in the superintendent can occur only after written authorization of the Owner.

CC. Pre-Construction Conference

1. A pre-construction conference will be scheduled by the Architect. The meeting shall include the General Contractor (including the Project Manager and Project Superintendent), the Architect (including the Inspecting Architect), the Owner, subcontractors, suppliers, utility representatives, and other concerned parties. At the time of the pre-construction conference, but not later than ten (10) days after official notification of the Contract Award, the Contractor shall submit the following to the Architect.
 - a. _____ Certificate of Liability Insurance
 - b. _____ Schedule of Construction (Bar Graph Preferred)
 - c. _____ Schedule of Values
2. The meeting agenda will include discussion of:
 - a. Critical sequencing, use of the premises
 - b. Utility installation and Coordination
 - c. Change Order procedures
 - d. Use of NCR Standard Field Report
 - e. Exchange of contact information
 - f. Engineering/Construction Requirements
 - g. Draws and Draw schedules
 - h. Equal Opportunity and Labor Standards
 - i. NCR=s 90-day policy and delivery procedures

DD. Anchor Bolts, Sleeves, etc.

1. Where any apparatus to be installed requires anchor bolts, these shall be furnished and set to template by the respective Contractors whose apparatus requires same. Where conduits pass through walls, floors or roof, sleeves consisting of sheet metal or steel pipe 1" larger than the required opening and extending flush with finished face shall be set by the Contractor requiring their

use. Same Contractor to seal sleeve as required by any and all local or state codes.

EE. Equipment, Final Connections, etc.

1. Unless otherwise shown and/or selected, all special furnishings and/or equipment will be furnished and installed by the equipment contractor. Each equipment vendor shall furnish all switches, outlet boxes, trim, safety devices, tail pieces, etc., unless specifically noted otherwise. Unless otherwise noted, the Contractor will bring services to indicated locations and make final connections to all equipment and this will include labor and material from the rough-in location to tail pieces, outlet boxes, etc.

FF. Lead Paint

1. No lead-based paint shall be used on this project, and no new material or product that contains leadbased paint shall be used on this project.

GG. Asbestos Materials

1. No asbestos or asbestos containing materials or products shall be used on this project. Further, the Architect and/or the Owner shall have the right to demand from the Contractor, subcontractor, material supplier and/or manufacturer a dated, signed and notarized certification stating that the building product contains no asbestos materials. Failure or refusal on the part of the Contractor, subcontractor, material supplier or manufacturer to furnish said certification shall be just cause to withhold future payments or release of retainage to the Contractor.

HH. Occupational Safety & Health Act

1. Each Contractor and all Subcontractors are hereby reminded that this Project is subject to the procedures and regulations of the Williams-Steiger Occupational Safety & Health Act, current edition with pertinent amendments. Along with the obligation to comply with those procedures and regulations, pay particular attention to and comply with the requirements of the Hazardous Communications Act. Each Subcontractor is responsible to obtain from the General Contractor (and acknowledge receipt of same) written Safety and Hazardous Communication Program material as required by OSHA pursuant to title 29CFR, subpart D, part 1296.59.

II. Hazardous Materials

1. Any hazardous materials uncovered and/or discovered by any Sub-Contractor during the course of the work are to be completely removed and disposed of by the Sub-Contractor. All Work, including disposal shall be in complete conformance with all Federal, State and local regulations.

JJ. Material Safety Data Sheets

1. Each Subcontractor is required to deliver all material safety data sheets pertaining to material Subcontractor brings on-site to General Contractor at General Contractor's on-site office.

KK. Liquidated Damages

1. The Contract amount will be reduced by .25% per day or \$200.00 (whichever is greater) for each day the work remains incomplete after the contract date set forth in their contract. Acts of God@, such as weather, will be taken into consideration when reviewing the completion date. If the work is being manned properly with skilled, experienced labor on a timely basis, there should be no need for liquidated damages to be incurred. Typically, this clause has not been exercised except when nonperformance appears to be intentional and scheduled building completion dates are put in peril. The completion days will not begin to run until the Contractor has been notified to commence.

LL. Cleaning Up

1. Cleaning up is critical, both during the course of the work and when the work is completed. Each Subcontractor is responsible for cleaning his work area daily,

including removing all rubbish from the buildings and placing same in the large waste containers located throughout the project, provided by the General Contractor. In the event Subcontractor does not satisfactorily complete daily cleanup or cleaning at the conclusion of the work, the General Contractor will cause the required cleanup to be completed and the Subcontractor will be charged. At completion of the work of all trades, the Contractor shall remove all temporary protection and clean adjacent surfaces.

2. The Contractor shall be responsible for cleaning and polishing floors; cleaning all painted, decorated or stained surfaces; cleaning and polishing all hardware and cleaning all tile work, fixtures and equipment, etc. Reference Cleaning: Section 01569

MM. Substantial Completion

1. Prior to final acceptance and at the request of the Contractor, the Owner/Architect may inspect and prepare a comprehensive Punch List for each of the respective phases or all of the Work. It shall be the responsibility of each Contractor to complete all items of the Owner/Architect's Punch List prior to application for final payment.

NN. Payments and Completion

1. Within forty-five (45) days after approval by Architect, the Owner will pay to the Contractor ninety percent (90%) of the value of all work performed and all materials suitably stored on the site, up to the first day of the month less the aggregate of previous payments. No payments will be made for materials stored off site. In order to be considered timely, Contractor shall submit copies of the following to Architect no more than four (4) working days after the first day of the month:
 - a. _____ Six (6) copies of invoice utilizing latest revised addition of the AIA Documents G702 & G703 for conventional projects, and HUD form 92448 Contractors Requisition@ for HUD projects.
 - b. _____ Six (6) Partial Waivers of Liens from General Contractor, all Subcontractors, & Material Suppliers
2. After final review and acceptance of the work by the Architect and the Owner, the Contractor shall submit for final payment. Final payment will be paid sixty (60) days after the following close out documents are received:
 - a. _____ Six (6) sets of Final Request for Payment, HUD form 92448 Contractors Requisition@ for HUD projects.
 - b. _____ Six (6) Final Waivers of Lien from General Contractor, all Subcontractors, & Major Material Suppliers
 - c. _____ Two (2) copies of all manufacturer's warranties
 - d. _____ Two (2) sets of all operation/maintenance manuals
 - e. _____ Two (2) copies of record drawings ("as-builts")
 - f. _____ Two (2) copies (including one original) of fully executed Certificate of Occupancy (if applicable)
 - g. _____ Two (2) copies of Contractor's affidavit of payment of debts and claims, AIA Document G706.
 - h. _____ Two (2) copies of Contractor's affidavit of release (waiver) of liens, AIA Document G706A.
 - i. _____ Two (2) copies of Consent of surety company to final payment, AIA Document G707.
 - j. _____ Two (2) copies of Evidence of completion requirements of governing authorities.
 - k. _____ Two (2) copies of Certificate of Occupancy (if temporary note why and when permanent CO is to be issued).
 - l. _____ Two (2) copies of Certificate of Inspection from all required agencies and departments having jurisdiction.

- m. _____ Two (2) copies of HUD Form No. 2485 B Permission to Occupy (if applicable).

OO. Warranties and Guarantees

1. The Contractor shall guarantee the quality of construction for a period of one (1) year (minimum) against defects in workmanship and materials. The Contractor will, at his own expense, make any and all repairs that may be necessary as a result of defects in workmanship and/or materials supplied by the Contractor. The guarantee period shall begin on the date of substantial completion of the project as declared by the Architect. The Contractor's guarantee for construction shall be submitted to the Architect for the Owner on the Contractor's company letterhead in the form prescribed by the Architect. Refer to individual specification sections for additional guarantee requirements.
2. All parties shall attend a 9 month and 12 month warranty inspection.
3. The Contractor shall assemble two (2) copies of all manufacturer's warranties for all guaranteed products and materials for this project. These warranties are not to supersede or exempt the Contractor's guarantee for construction but to act in conjunction with such guarantee.

PP. Debriefing Meeting

1. A post-construction Debriefing Meeting will be scheduled by the Owner. The meeting shall include the General Contractor (including the Project Manager and Project Superintendent), the Architect (including the Inspecting Architect), and the Owner.

END OF SECTION 00800

**SECTION 01 1000
SUMMARY OF WORK**

PART 1

1.01 SCOPE

- A. The scope of work includes all labor, tools, equipment, materials and supervision to complete the work as follows
- B. Beechwood Apartments is an existing 149-unit multifamily complex consisting of one, 13-story building that houses an assortment of studios, one, two-bedroom garden flats, and one-bedroom accessible garden flats units. Shared common amenities are located on the first floor. The proposed renovations will result in a total of 146 units, with 20% being accessible upon completion. The project is being developed under OHFA Limited Scope Rehabilitation Sustainability Standards and must meet all requirements. Accessibility will be in conformance with the Fair Housing Act Guidelines, ICC/ANSI A117.1-2009, Ohio Building Code, and Americans with Disabilities Act Architectural Guidelines.

PART 2

2.01 JOB REQUIREMENTS:

- A. The requirements set forth in Division I shall apply to all Contractors and/or Subcontractors. Throughout the body of the specifications, the terms "General Contractor", "Contractor", "Plumbing Contractor", "HVAC Contractor", "Mechanical Contractor", "Electrical Contractor", "Subcontractor", etc., are used and these terms shall indicate general and specific areas of responsibility. No "request for extra" will be entertained from any Contractor which arise out of interpretation of this language. The work will be bid and pursued under one (1) general construction contract. Products not specified but meeting the specification may be incorporated in the work provided they are approved in advance by the Architect. Refer to specification Section 01630 SUBSTITUTIONS AND PRODUCT OPTIONS.
- B. Throughout the body of the specifications, from time to time, work required in one section and/or division of work is referred to from another section and/or division of work. Contractors are required to refer to all divisions of these specifications. The Contractor shall notify the Architect of the existence of any discrepancies found between the information contained in these plans and specification and actual field conditions. Notification shall be in writing seven (7) business days prior to the Initiation of Work. Failure to do so indicates acceptance by the Contractor of the information listed.

2.02 SPECIAL REQUIREMENTS

- A. The Contractor will submit a work schedule.
- B. All work, except as noted otherwise, shall be performed between 7:00 a.m. to 5:00 p.m., Monday through Friday, excluding official state holidays. At each building and at the end of each day, remove all waste material, e.g., boxes, packing, debris, etc., and leave the area broom clean. Nails, sheet metal cut-offs and other sharp material shall be cleaned up regularly during the work. No such material shall remain at the end of the day
- C. Workman shall park their vehicles where directed. No parking will be permitted on access roads and mobilization areas. Fire lanes shall be kept clear at all times to maintain access.
- D. All Contractors shall be licensed as required by local and state agencies. Contractors shall verify these requirements with the respective governing agencies.

END OF SECTION

**SECTION 01 2000
PRICE AND PAYMENT PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Price and Contract Time.
- C. Change procedures.

1.02 RELATED REQUIREMENTS

- A. Section 00 5200 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.
- B. Document 00 7200 - General Conditions and Document 00 7300 - Supplementary Conditions: Additional requirements for progress payments, final payment, changes in the Work.
- C. Document 00 7300 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.
- D. Section 01 2100 - Allowances: Payment procedures relating to allowances.
- E. Section 01 2200 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.

1.03 SCHEDULE OF VALUES

- A. Form to be used:
 - 1. For HUD projects use HUD form 2328.
 - 2. For conventional projects use AIA Document G703 and the Project Manual table of contents as a guide to establish line items for the Schedule of Values.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date of Owner/Contractor Agreement.
- E. Format: Utilize Table of Contents and Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization, bonds and insurance, and Labor and Material.
- F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.04 COST CERTIFICATION

- A. The General Contractor shall cost certify the project in accordance with Ohio Housing Finance Agency's Cost Certification Guidelines. These guidelines are available on their website at <https://ohiohome.org/lihtc/ContractorsCostGuidelines.pdf>

1.05 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Monthly unless otherwise stipulated in the contract agreement. .
- B. Form to be used:
 - 1. For HUD projects use HUD form 2328.
 - 2. Contractors Requesuib HUD 92448
 - 3. Construction Progress Schedule HUD 5372
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. Execute certification by signature of authorized officer.

- F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- G. Submit one electronic and three hard-copies of each Application for Payment.
- H. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01 3000.
 - 2. Construction progress schedule, revised and current as specified in Section 01 3000.
 - 3. Partial release of liens from major subcontractors and vendors.
 - 4. Affidavits attesting to off-site stored products.
- I. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of the submittal. Show application number and date, and line item by number and description.

1.06 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
 - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.
- D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6300.
- E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's approved price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 - 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs and pricing consistent with line item costs already established by the contract.
- F. Substantiation of Costs: Provide full information required for evaluation.
 - 1. Provide following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.

- e. Credit for deletions from Contract, similarly documented.
- 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- G. Execution of Change Orders: Contractor will issue Change Orders (HUD 92437) for signatures of parties as provided in the Conditions of the Contract.
- H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.
- I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- J. Promptly enter changes in Project Record Documents.

1.07 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 - 1. All closeout procedures specified in Section 01 7000.

END OF SECTION

**SECTION 01 2100
ALLOWANCES**

GENERAL

1.01 THE FOLLOWING CASH ALLOWANCE(S) SHALL BE INCLUDED IN THE BASE BID. OVERHEAD, PROFIT AND OTHER EXPENSES CONTEMPLATED FOR THE STATED ALLOWANCE AMOUNT SHALL BE INCLUDED IN THE BASE BID AND NOT IN THE ALLOWANCE.

1.02 ALLOWANCE AMOUNTS

END OF SECTION

**SECTION 01 2300
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.

1.02 RELATED REQUIREMENTS

- A. Document 00 2113 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.
- B. Document 00 4323 - Alternates Form: List of Alternates as supplement to Bid Form.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 2600
CONTRACT CHANGE PROCEDURES**

PART 1

1.01 GENERAL

- A. Definitions:
1. Change Order: A written order to the Contractor, signed by the Owner, Architect, HUD and Contractor, which amends the Contract Documents as described and authorizes the Contractor to proceed with a change which affects the Contract Sum and/or Contract Time stated therein as a specific cost and/or time, respectively. This document may also be the result of a Change Bulletin or Construction Change Directive.
 2. All Change Orders must be signed by all three parties to be legal and binding and shall not be drawn upon as a part of a pay request until fully executed.
 3. Proposal Request: A written order initiated by the Project Architect which is a request for cost on the work described therein. A Proposal Request does not authorize the Contractor to proceed with the work involved. A Proposal Request, accepted by the Owner and Architect, shall become a Change Order. An itemized cost breakdown for the work described shall be submitted by the Contractor.
 4. Architect's Supplemental Instructions: Written supplemental instructions or interpretations, signed by Architect making minor changes in the work not involving a change in Contract Sum or Contract Time which is to be signed and accepted by the Contractor.

PART 2

2.01 DOCUMENTATION OF PROPOSALS

- A. Support each quotation for a lump sum proposal, and for each unit price which has not previously been established, with sufficient substantiating data to allow Architect to evaluate the quotation.
- B. Provide data to support time and cost computations:
1. Labor required.
 2. Construction equipment required.
 3. Products required:
 - a. Recommended source of purchase and unit cost.
 - b. Quantities required.
 - c. Taxes, insurance and bonds.
 - d. Profit per Section 007200, Supplemental General Conditions.
 - e. Credit for work deleted from contract, similarly documented.
 - f. Change in contract time, if any.
 4. Document requests for substitutions for products as specified in Section 01630.

END OF SECTION 013200

**SECTION 01 2700
UNIT PRICES**

PART 1

1.01 THE FOLLOWING UNIT PRICES SHALL BE INCLUDED IN EACH CONTRACTOR'S BID AND SHALL BE USED TO ADD TO OR DEDUCT FROM THE CONTRACTOR'S BASE BID. ALL PRICES SHALL BE FOR COMPLETE COST OF ITEM FULLY INSTALLED. REFER TO SEPARATE SPECIFICATION SECTIONS FOR DETAILED DESCRIPTIONS. UNIT PRICES WILL NOT BE USED FOR ADDITIONAL WORK IF, IN THE OPINION OF THE ARCHITECT, THE VALUES SEEM OUT OF LINE WITH CURRENT COSTS.

A. Unit Price 1

1. On-site excavation of earth: \$_____/cu.yd.

B. Unit Price 2:

1. Off-site borrow, clean granular backfill material, in place and compacted:
\$_____/cu.yd.

END OF SECTION

**SECTION 01 3100
PROJECT COORDINATION**

SCOPE

1.01 RELATED REQUIREMENTS:

- A. Conditions of the Contract.
 - 1. Section 011000 SUMMARY OF WORK.
 - 2. Section 014010 TESTING LABORATORY SERVICES.
 - 3. Section 00 7200 GENERAL CONDITIONS
 - a. AIA Document A201 (2007) General Conditions to the Contract for Construction
 - 4. Section 00 800 SUPPLEMENTARY CONDITIONS
- B. Utility Shut-Offs and Changeovers:
 - 1. Notify the Architect and Owner at least 72 hours in advance of utility connections or shutoff. Coordinate these operations with the Owner, through the Architect, and complete the work in the minimum amount of time.
 - 2. Utility services and building services shut-offs result in extremely critical curtailment of building services and operation. Shut-offs must be accomplished at the Owner's schedule, and overtime, round the clock, holiday or weekend work may be required at no additional cost to the Owner; or at the Contractors' option, by-pass service may be provided.
- C. Progress of the Work: Keep Architect informed of the progress of the work.
- D. Deliveries: If requested, provide verification of delivery dates required to conform to the then current project construction schedule.
- E. Chases: Unless otherwise specified or indicated, all items such as piping, ductwork and conduit shall be concealed in walls or chases. Cutting or chasing required after walls are in place shall be performed by the proper trades or crafts at the expense of the trade or craft requiring the cutting of chasing.
- F. Tests: Where the contract documents require any work to be tested, the Architect shall be notified sufficiently in advance so that he may observe such tests.
- G. Each Sub-Contractor shall be responsible for coordination of their work with the entire scope of the project defined by the Construction Drawings and Specifications.

END OF SECTION 013410

**SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.
- E. Submit HUD Form 5372.

1.03 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.04 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum _18" _x _24" _ inches or width required.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.03 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.04 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

3.05 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

**SECTION 01 3300
SUBMITTAL PROCEDURES**

SCOPE

1.01 THIS SECTION INCLUDES ADMINISTRATIVE AND PROCEDURAL REQUIREMENTS FOR SUBMITTALS REQUIRED FOR PERFORMANCE OF THE WORK, INCLUDING THE FOLLOWING:

- A. Shop drawings.
 - 1. Product data.
 - 2. Samples.
 - 3. Quality Requirements

1.02 SUBMITTAL PROCEDURE

- A. Contractors and Subcontractors that are required to submit information shall submit to the Architect the following:
 - 1. Shop Drawings: Minimum six (6) sets of drawings. Four (4) will be returned.
 - 2. Number of Copies: Architect and any associated outside consultant will retain one print each; remainder will be returned. Consequently, GC shall submit as many copies needed to meet foregoing requirement and their own distribution needs.
 - 3. The Contractors and Subcontractors submitting drawings and/or product information shall allow ten (10) working days processing time for the Architect to review and return such submittals. The Architect will not be held responsible for delays in construction resulting from the Contractor and Subcontractor being required to resubmit drawings and/or product information. Contractors and subcontractors shall correct and return to Architect submittals marked either "Note Markings", "Resubmit", "Rejected", or "Not Reviewed" within ten (10) calendar days.
 - 4. The General Contractor shall review all shop drawings and other submittals received from all sub-contractors and material men for conformance with drawings and specifications. If the General Contractor cannot verify required conformance with the Contract Documents, shop drawings and all other submittals shall be resubmitted by the General Contractor to the subcontractors and material suppliers for correction prior to the General Contractor's submittal to the Architect. Shop drawings or other submittals transmitted by the General Contractor to the Architect and/or to the Owner attest that a complete review for accuracy and application for the project has been completed to very conformance with the Contract Documents.
 - 5. Shop Drawings authors, Contractors and Subcontractors submitting drawings and/or product information shall allow ten (10) working days processing time for the Architect to review and return such submittals. The Architect will not be held responsible for delays in construction resulting from the Contractor and Subcontractor being required to resubmit drawings and/or product information. Contractors and subcontractors shall correct and return to Architect submittals marked either "Note Markings", "Resubmit", "Rejected", or "Not Reviewed" within ten (10) calendar days.

1.03 SHOP DRAWINGS

- A. Submittals shall be made through the General Contractor. Submittals not received from the General Contractor shall be returned without review.
- B. Shop drawings not requested by the Architect shall be returned without action
- C. If items to be installed are in exact accordance with the contract documents, shop drawings submission is not required. Should alterations or substitutions be proposed for any given item, shop drawing submission is required.

- D. The Contractor shall not perform any portion of the Work requiring submittal and review of shop drawings, product data, samples or similar submittals until the respective submittal has been approved by the Architect. Such Work shall be in accordance with approved submittals.
- E. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the bases of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
 - 1. AutoCAD Drawings: A CD copy of CAD Drawings may be available from the Architect. The Contractor requiring this service must contact the Architect to verify availability. Cost to obtain AutoCAD drawings will be \$150.00 per Drawing Sheet. Request for CD copy should be addressed to the Project Architect.
- F. Shop Drawings shall include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included by sheet and detail number or by schedule identification number.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurements.
- G. By approving and submitting shop drawings, the Contractor thereby represents that he has determined and verified field measurements, field construction criteria, materials, catalog numbers, and similar data, and that he has checked and coordinated each shop drawing with the requirements of the Work and of the Contract Documents prior to submitting to the Architect.
 - 1. Contractor shall review all submittals, then stamp and sign indicating their review and action taken prior to submitting to the Architect. Failure to review, stamp and sign will result in the shop drawing being returned without review. Any delay incurred as a result of the Contractor providing submittals not reviewed, stamped and signed shall be the full responsibility of the Contractor. The time allowed for the Architect to review submittals shall start over at the re-submission of any and all submittals.
- H. The Contractor shall make corrections required by the Architect and shall resubmit the required number of corrected copies of shop drawings until appropriately marked. The Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the Architect on previous submissions.
- I. The Architect will review shop drawings only for conformance with the design concept of the Project and with the information given in the Contract Documents. The Architect's review of a separate item shall not indicate review of an assembly in which the item functions.
 - 1. Only shop drawings, product data, and samples marked "No Exceptions Taken" or "Note Markings/Confirm" shall be considered "final" and used in conjunction with the work of this Project.
- J. The Architect's review of shop drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the Architect in writing of such deviation at the time of submission and the Architect has given written approval to the specific deviation, nor shall the Architect's action relieve the Contractor from responsibility for errors or omissions in the shop drawings.
 - 1. The Architect's review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and qualities, or for substantiating instructions or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the

Contract Documents. Unless otherwise specifically stated by the Architect, the Architect's review shall not constitute approval of safety precautions or, of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which it is a component.

- K. Notations and remarks added to shop drawings by the Architect are to insure compliance to Drawings and Specifications and do not imply a requested or approved change to contract cost.
- L. Should deviations, discrepancies, or conflicts between shop and contract drawings and Specifications be discovered, either prior to or after review, Contract Documents shall control and be followed.
- M. Shop drawings will be marked as follows: Contractor shall take the following action for each respective marking:
 - 1. "REVIEWED" - Copies will be distributed as indicated under above schedule.
 - 2. FURNISH AS CORRECTED" - Final but Restricted Release; Contractor may proceed with fabrication, taking into account the necessary corrections on submittal and ensuring full compliance with Contract Documents.
 - 3. REVISE AND RESUBMIT" - Contractor may begin but not complete fabrication, taking into account the necessary corrections. Submittal shall be resubmitted incorporating all corrections and Contract Document requirements before fabrication of this work is completed to obtain a different action marking. Do not allow drawings marked "Resubmit" to be used in connection with installation of the Work.
 - 4. REJECTED" - Contractor will be required to resubmit submittals in their entirety. No fabrication or installation shall be started until submittals so marked have been completely revised, resubmitted, and marked by Architect according to preceding Paragraphs a or b.
 - 5. "SUBMIT SPECIFIED ITEM" - Submittals were not reviewed because they are not indicative of what was specified. Contractor shall either submit a request for substitution or resubmit a new submittal compliant with the Contract Documents.

1.04 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, rough-in diagrams and templates, standard wiring diagrams, and performance curves.
 - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 - g. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 - 1) Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
 - h. Submittals: Submit copies in accordance with Section C, item 11 above. The Architect will retain two and will return the others marked with action taken and corrections or modifications required.
 - 1) Unless non-compliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

- i. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - 1) Do not proceed with installation until a copy of Product Data is in the installer's possession.
 - 2) Do not permit use of unmarked copies of Product Data in connection with construction.
- B. In compliance with the OSHA Hazard Communication Standard (1910.1200, 08-24-1987), Contractors shall post at the site MSDS (Material Safety Data Sheets) for ALL products classified as hazardous that their firm has knowledge that they will be furnishing, using, or storing on the job site during the duration of this Project in accordance with OSHA standards. At the completion of the project, the Contractor shall turn their "MSDS" information directly over to the Owner with a receipt for the Owner to sign. A copy of the signed receipt only shall be submitted to the Architect.
 1. Material Safety Data Sheets (MSDS) shall not be submitted to the Architect for review. Material Safety Data Sheets submitted to Architect will be returned with no action taken.

1.05 SAMPLES

- A. The Contractor shall submit to the Architect triplicate samples to illustrate materials or workmanship, colors, and textures, and establish standards by which the Work will be judged.
 1. Submit full size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern. Where variation in color, pattern, texture, and other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
- B. By approving and submitting samples, the Contractor thereby represents that he has determined and verified materials, catalog numbers, and similar data, and that he has checked and coordinated each sample with the requirements of the Work and of the Contract Documents prior to submitting to the Architect.
- C. The Architect will review samples but only for conformance with the design concept of the Project and with the information given in the Contract Documents. The Architect's review of a separate item shall not indicate approval of an assembly in which the item functions.
- D. The Architect's action shall not relieve the Contractor of responsibility for deviations from the requirements of the Contract Documents unless the Contractor has informed the Architect in writing of the deviation at the time of submission and the Architect has given written approval to the specific deviation, nor shall the Architect's action relieve the Contractor from responsibility for errors or omissions in the samples.
- E. Materials shall not be ordered until final review is received in writing from the Architect. Materials shall be furnished, equal in every respect to reviewed samples. Where color or shade cannot be guaranteed, the maximum deviation shall be indicated by the manufacturer. Work shall be in accordance with the final reviewed samples.

1.06 QUALITY REQUIREMENTS

- A. Delegated Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to the Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

- B. Mock-ups of certain exterior and interior finish products and assemblies will be required. Items to be mocked up will include brock and stone or other masonry veneers, windows, siding, trim, and color samples. Interior finishes may include assemblies of millwork, colors, flooring materials, etc. Refer to Section 01 4000 Quality Requirements.

END OF SECTION 013300

**SECTION 01 3553
SECURITY PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including formal security program, entry control, personnel identification, guard service, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: use of premises and occupancy.
- B. Section 01 5000 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

- A. Protect Work , existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program at project mobilization.
- C. Maintain program throughout construction period until Owner occupancy.

1.04 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.

1.05 PERSONNEL IDENTIFICATION

- A. Provide identification badge to each person authorized to enter premises.
- B. Badge To Include: Personal photograph, name, assigned number , expiration date and employer.
- C. Require return of badges at expiration of their employment on the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 4000
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.
- C. Section 01 2100 - Allowances: Allowance for payment of testing services.
- D. Section 01 4216 - Definitions.
- E.

1.03 REFERENCE STANDARDS

- A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2019.
- C. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2020.
- D. IAS AC89 - Accreditation Criteria for Testing Laboratories 2018.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Testing Agency Qualifications:
 - 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.

- c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
- 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
- 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.

1.05 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform specified special third party inspections identified by the 2011 Ohio Building Code.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Notify Architect and owner Consultant fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- H. Obtain Architect's acknowledgement of mock-ups before starting work, fabrication, or construction.
 - 1. Make corrections as necessary.
- I. Accepted mock-ups shall be a comparison standard for the remaining Work.
- J. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

**SECTION 01 4216
DEFINITIONS**

PART 1 GENERAL

1.01 SUMMARY

- A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Provide: To furnish and install.
- E. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 4533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

1.03 DEFINITIONS

- A. Code or Building Code: ICC (IBC), 2015 Edition of the International Building Code and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. International Accreditation Service, Inc. (IAS).
- D. National Institute of Standards and Technology (NIST).
- E. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.04 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).
- B. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.
- C. AISC 341 - Seismic Provisions for Structural Steel Buildings 2016 (Revised 2018).
- D. AISC 360 - Specification for Structural Steel Buildings 2016.
- E. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.
- F. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2020.
- G. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2015.
- H. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members 1993, with Editorial Revision (2015).

- I. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members 2019.
- J. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide 2014.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- L. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018.
- M. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel 2018.
- N. IAS AC89 - Accreditation Criteria for Testing Laboratories 2018.
- O. IAS AC291 - Accreditation Criteria for Special Inspection Agencies 2017.
- P. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SUBMITTALS

- A. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- B. Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.
- C. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to Architect and one to the AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Compliance with Contract Documents.
 - 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- D. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector shall promptly submit two copies of report; one to Architect and one to AHJ.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.

- d. Date and time of special inspection.
 - e. Identification of fabricated item and specification section.
 - f. Location in the Project.
 - g. Results of special inspection.
 - h. Verification of fabrication and quality control procedures.
 - i. Compliance with Contract Documents.
 - j. Compliance with referenced standard(s).
- E. Test Reports: After each test or inspection, promptly submit two copies of report; one to Architect and one to AHJ.
- 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with Contract Documents.
- F. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
- 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.
- G. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
- 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.
- H. Fabricator's Field Reports: Submit reports to Architect and AHJ.
- 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.

1.06 SPECIAL INSPECTION AGENCY

- A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling required by the building code .
- B. The Contractor will coordinate with the Owner's Special Inspection Agency all required inspections and shall be responsible to arrange, schedule and notify the Special Inspection Agency accordingly.
- C. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
- D. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.07 TESTING AND INSPECTION AGENCIES

- A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code .
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.08 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC291.
- B. Testing Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC89.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC).
- B. High-Strength Bolt, Nut and Washer Material:
 - 1. Verify identification markings comply with ASTM standards specified in the approved contract and to AISC 360, Section A3.3; periodic.
 - 2. Submit manufacturer's certificates of compliance; periodic.
- C. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.
 - 1. Snug tight joints; periodic.
- D. Structural Steel and Cold Formed Steel Deck Material:
 - 1. Structural Steel: Verify identification markings comply with AISC 360, Section M3.5; periodic.
 - 2. Other Steel: Verify identification markings comply with ASTM standards specified in the approved contract documents; periodic.
 - 3. Submit manufacturer's certificates of compliance and test reports; periodic.
- E. Weld Filler Material:
 - 1. Verify identification markings comply with AWS standards specified in the approved contract documents and to AISC 360, Section A3.5; periodic.
 - 2. Submit manufacturer's certificates of compliance; periodic.
- F. Welding:
 - 1. Structural Steel and Cold Formed Steel Deck:
 - a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - b. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - c. Single Pass Fillet Welds Less than 5/16 inch Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
 - d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
 - e. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
 - f. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.
 - 2. Reinforcing Steel: Verify items listed below comply with AWS D1.4/D1.4M and ACI 318, Section 3.5.2.
 - a. Verification of weldability; periodic.
 - b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
 - c. Shear reinforcement; continuous.
 - d. Other reinforcing steel; periodic.

- G. Steel Frame Joint Details: Verify compliance with approved contract documents.
 - 1. Details, bracing and stiffening; periodic.
 - 2. Member locations; periodic.
 - 3. Application of joint details at each connection; periodic.

3.02 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved contract documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.
- B. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, Section 3.5.2; periodic.
- C. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.
- D. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, Sections 5.11 through 5.13; periodic.
- E. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents and ACI 318, Section 6.2, for the following.
- F. Formwork Shape, Location and Dimensions: Verify compliance with approved contract documents and ACI 318, Section 6.1.1; periodic.

3.03 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

- A. Masonry Structures Subject to Special Inspection:
 - 1. Empirically designed masonry, glass unit masonry and masonry veneer in structures designated as "essential facilities".
 - 2. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".
- B. Verify each item below complies with approved contract documents and the applicable articles of TMS 402/602.
 - 1. Inspections and Approvals:
 - a. Verify compliance with the required inspection provisions of the approved contract documents; periodic.
 - b. Verify approval of submittals required by contract documents; periodic.
 - 2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
 - 3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
 - 4. Joints and Accessories: When masonry construction begins, verify:
 - a. Proportions of site prepared mortar; periodic.
 - b. Construction of mortar joints; periodic.
 - c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
 - 5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
 - a. Size and location of structural elements; periodic.
 - b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
 - c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
 - d. Welding of reinforcing bars; continuous.
 - 6. Grouting Preparation: Prior to grouting, verify:
 - a. Grout space is clean; periodic.
 - b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.

- c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
- d. Correctly constructed mortar joints; periodic.
- 7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.

3.04 SPECIAL INSPECTIONS FOR PREFABRICATED WOOD CONSTRUCTION

- A. High Load Diaphragms: Verify compliance of each item below with approved contract documents.
 - 1. Grade and thickness of sheathing.
 - 2. Nominal size of framing members at adjacent panel edges.
 - 3. Nail or staple diameter and length.
 - 4. Number of fastener lines.
 - 5. Fastener spacing at lines and at edges.
- B. Metal Plate Connected Wood Trusses with Clear Span of 60 feet or More: Verify compliance of each item below with approved contract documents in general and with approved truss submittal package in particular.
 - 1. Temporary restraint and bracing.
 - 2. Permanent individual truss member restraint and bracing.

3.05 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 - 1. Design bearing capacity of material below shallow foundations; periodic.
 - 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 - 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
 - 4. Subgrade, prior to placement of compacted fill; periodic.
- B. Testing: Classify and test excavated material; periodic.

3.06 SPECIAL INSPECTIONS FOR DRIVEN DEEP FOUNDATIONS

- A. Materials, Equipment and Final Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 - 1. Material types, sizes and lengths; continuous.
 - 2. Capacities of test elements and additional load tests as required; continuous.
 - 3. Placement locations and plumbness; continuous.
 - 4. Type and size of hammer; continuous.
- B. Installation: Observe driving operations and maintain complete and accurate records for each element; continuous.
 - 1. Record number of blows per foot of penetration.
 - 2. Determine penetration required to achieve design capacity.
 - 3. Record tip and butt elevations.
 - 4. Document any damage to foundation element.

3.07 SPECIAL INSPECTIONS FOR CAST-IN-PLACE DEEP FOUNDATIONS

- A. Materials, Equipment and Final Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 - 1. Element length; continuous.
 - 2. Element diameters and bell diameters; continuous.
 - 3. Embedment into bedrock; continuous.
 - 4. End bearing strata capacity; continuous.
 - 5. Placement locations and plumbness; continuous.
 - 6. Type and size of hammer; continuous.

- B. Drilling Operations: Observe and maintain complete and accurate records for each element; continuous.
- C. Material Volume: Record concrete and grout volumes.
- D. Concrete Elements Associated with Cast-in-Place Deep Foundations: Perform additional inspections as required by the Special Inspections for Concrete Construction article of this section.

3.08 SPECIAL INSPECTIONS FOR VERTICAL MASONRY FOUNDATION ELEMENTS

- A. Vertical Masonry Foundation Elements are subject to the same special inspection requirements listed in the "Special Inspections for Masonry Construction" Article of this section.

3.09 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

- A. Sprayed Fire Resistant Materials, General:
 - 1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved contract documents, and with applicable requirements of the building code.
 - 2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.
- B. Physical and visual tests: Verify compliance with fire resistance rating.
 - 1. Condition of substrates; periodic.
 - 2. Thickness of sprayed fire resistant material; periodic.
 - 3. Density of sprayed fire resistant material in pounds per cubic foot; periodic.
 - 4. Bond strength (adhesion and cohesion); periodic.
 - 5. Bond strength (cohesion); periodic.
 - 6. Condition of finished application; periodic.
- C. Structural member surface conditions:
 - 1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
 - 2. Verify preparation of structural member surfaces complies with approved contract documents and manufacturer's written instructions; periodic.
- D. Application:
 - 1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
 - 2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.
- E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved contract documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
 - 1. Minimum Allowable Thickness: Tested according to ASTM E605/E605M, periodic.
 - a. Design thickness 1 inch or greater: Design thickness minus 1/4 inch.
 - b. Design thickness greater than 1 inch: Design thickness minus 25 percent.
- F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved contract documents.
- G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot when in-place samples of the cured material are tested according to ASTM E736/E736M and as described below.

3.10 SPECIAL INSPECTIONS FOR MASTIC AND INTUMESCENT FIRE RESISTANT COATINGS

- A. Verify mastic and intumescent fire resistant coatings comply with AWCI 117 and the fire resistance rating indicated on approved contract documents.

3.11 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

- A. Structural Steel: Comply with the quality assurance plan requirements of AISC 341.
- B. Structural Wood:
 - 1. Field gluing; continuous.
 - 2. Nailing, bolting, anchoring and other fastening of components within the seismic force-resisting system; periodic.
- C. Cold Formed Steel Light Frame Construction:
 - 1. Field welding; periodic.
 - 2. Screw attachment, bolting, anchoring and other fastening of components within the main seismic force-resisting system; periodic.
- D. Designated Seismic System Verification: Verify label, anchorage or mounting complies with certificate of compliance provided by manufacturer or fabricator.
- E. Seismic Isolation System:
 - 1. Fabrication and installation of isolator units; periodic.
 - 2. Fabrication and isolation of energy dissipation devices; periodic.
- F. Structural Observations for Seismic Resistance: Visually observe structural system for general compliance with the approved contract documents; periodic.

3.12 SPECIAL INSPECTIONS FOR WIND RESISTANCE

- A. Structural Wood:
 - 1. Field gluing of components in the main wind force-resisting system; continuous.
 - 2. Nailing, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic.
- B. Cold Formed Steel Light Frame Construction:
 - 1. Field welding; periodic.
 - 2. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic
- C. Structural Observations for Wind Resistance: Visually observe structural system for general compliance with the approved contract documents; periodic.

3.13 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 3. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- C. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.14 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
- C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.15 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:
 - 1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 - 2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 - 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- B. Contractor Responsibilities, Seismic Force-Resisting Systems: Submit written statement of responsibility for each item listed to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
- C. Contractor Responsibilities, Wind Force-Resisting Systems: Submit written statement of responsibility for each item listed to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

END OF SECTION

**SECTION 01 5000
TEMPORARY FACILITIES**

PART 1

1.01 SANITATION, LIGHT, POWER, HEAT & WATER

- A. Contractor shall provide the following temporary utilities during construction: electricity, heat and potable water.
- B. It will be the Contractor's responsibility to provide such temporary toilet facilities as required and to introduce and enforce among his employees such regulations in regard to cleanliness and the disposal of garbage and waste as shall be required to maintain a neat and clean building and shall comply with all local ordinances. The Contractor shall take such means as the Architect may direct to effectually prevent the creation of a nuisance on the work or on any part of the property of the Owner.

1.02 OFFICE, STORAGE AND FACILITIES FOR ARCHITECT'S REPRESENTATIVE

- A. The Contractor shall take charge of the work during construction and shall provide an office "area", at an approved location. This area shall have copies of all correspondence, construction drawings and specifications including all changes and revisions and shop drawings.
- B. The Contractor shall provide any such waterproofed and secure storage sheds or trailers as required to protect his materials and the Owners materials. Remove all temporary structures upon completion of the work.
- C. Storage sheds and trailers on site may be installed or used only with prior approval of the Owner. Locate as directed.

1.03 TELEPHONE SERVICE

- A. The Contractor shall provide either a portable telephone (cellular phone) or a telephone at a fixed location on the job during the operations for his own use in the work and the use of all subcontractors engaged in the work. Toll charges will be paid by the persons making the long distance calls. The superintendent shall carry either a cordless phone or a pager so that he may be contacted any time during working hours.

1.04 DISPOSAL FACILITIES

- A. The Contractor shall provide dumpsters at the project for the duration of the project, locate in areas as approved by the Owner. Use of the Owner's dumpsters (if applicable) is prohibited. The Contractor may choose to remove all refuse on a daily basis in lieu of providing a dumpster.

1.05 BARRICADES AND WARNINGS

- A. The General Contractor shall construct and maintain all barricades as required to provide protection to the public and to the work. Danger signals, warning signs, red flags, lanterns and lights shall be provided and maintained as needed. All the above shall comply with all applicable codes and ordinances and shall be as approved by the Owner and the Architect.

END OF SECTION 015000

**SECTION 01 5480
UTILITY PROTECTION**

SCOPE

1.01 RELATED REQUIREMENTS:

- A. Conditions of the Contract.
 - 1. Section 011000 SUMMARY OF WORK.
 - 2. Division 2 - Sitework: Utilities.
 - 3. Division 15 - Mechanical.
 - 4. Division 16 - Electrical.
- B. Job Requirements:
 - 1. Existing utility lines and structures indicated or known, and utility lines constructed for this project shall be protected from damage during construction operations. It is the Contractor's responsibility to contact the appropriate underground utility location agency to ensure that all recorded underground utility lines are properly marked. Repair to damaged utilities resulting from Contractor failing to take the proper precaution will be paid for at the Contractor's expense.
 - 2. Locate and flag all lines and structures before beginning excavation and other construction operations.

1.02 REMOVAL AND RELOCATION

- A. When utility lines and structures that are to be removed or relocated are encountered within the area of operations, notify the Architect and affected utility in ample time for the necessary measures to be taken to prevent interruption of the services.

1.03 UNKNOWN LOCATIONS

- A. Damage to existing utility lines or structures not indicated or known shall be reported immediately to the Architect and the affected utility. If determined that repairs are required under the Contract, the Contract Amount will be adjusted in accordance with the Conditions to the Contract

END OF SECTION

**SECTION 01 5690
CLEANING**

GENERAL

1.01 RELATED REQUIREMENTS: AS SPECIFIED ELSEWHERE:

- A. Supplementary General Conditions: Section 00800
 - 1. Summary of Work: Section 011000
 - 2. Cleaning for Specific Products or Work
 - 3. Specification Section for that Work
- B. All cleaning shall be the responsibility of the Contractor unless specifically noted otherwise.
- C. Contractor shall police and clean-up on a continuing basis, during his presence in the project, in all areas in which he is performing work; maintain premises and public properties free from accumulation of waste, debris, and rubbish.
- D. At the completion of the Work, Contractor shall remove waste materials, rubbish, tools, equipment, machinery, and surplus materials and clean all sight-exposed surfaces. Leave project clean and ready for final cleaning.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- A. Maintain project in accordance with Occupational Safety and Health Act, latest edition, as it applies to clean-up.
- B. Conduct cleaning and disposal operations in compliance with local ordinances and anti-pollution laws.
 - 1. Do not burn or bury rubbish and waste materials on site.
 - 2. Do not dispose or volatile waste, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.

1.03 PRODUCTS

- A. Use only cleaning materials recommended by manufacturer of surface to be cleaned, and use cleaning materials only on surfaces recommended by cleaning material manufacturer.

1.04 EXECUTION

- A. During Construction: Execute cleaning to ensure that the building, grounds, and public properties are maintained free from accumulation of waste and rubbish.
 - 1. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
 - 2. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris, and rubbish.
 - 3. Provide on-site containers for collection of waste materials, debris, and rubbish.
 - 4. Remove waste materials, debris, and rubbish from site and legally dispose of at a public or private dumping area off Owner's property.
 - 5. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
 - 6. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
 - 7. Refer to Section 01 7000 Execution sub-section 2.09 Progress Cleaning for additional requirements.
- B. Final Cleaning: The Contractor shall be responsible for final cleaning.
 - 1. Employ experienced workmen and/or professional cleaners for final cleaning.
 - 2. In preparation for substantial completion or occupancy, conduct final inspection of sight exposed interior and exterior surfaces and of concealed spaces.
 - 3. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed surfaces; polish surfaces so designated to shine finish.

4. Repair, patch and touch-up marred surfaces to specified finish, to match adjacent surfaces.
5. Remove all foreign materials from site areas.
6. Broom clean paved surfaces; rake clean other surfaces of grounds.
7. Remove snow and ice from access to building if applicable.
8. Contractor shall be responsible for cleaning all equipment installed.
9. Maintain cleaning until project or portion thereof is occupied by Owner.

END OF SECTION 015690

**SECTION 01 5713
TEMPORARY EROSION AND SEDIMENT CONTROL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Performance bond.
- E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 01 3329 - Sustainable Design Reporting: Submittal procedures for sustainable design documentation.
- B. Section 31 1000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.
- C. Section 31 2200 - Grading: Temporary and permanent grade changes for erosion control.
- D. Section 32 1123 - Aggregate Base Courses: Temporary and permanent roadways.
- E. Section 32 9219 - Seeding: Permanent turf for erosion control.
- F. Section 32 9223 - Sodding: Permanent turf for erosion control.
- G. Section 32 9300 - Plants: Permanent plantings for erosion control.

1.03 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus 2021.
- B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity. 1999a (Reapproved 2014).
- C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles 2015.
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles 2015a.
- E. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile 2020b.
- F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples 2017 (Reapproved 2021).
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit Current Edition.
- H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control 1995.
- I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service 2015.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.

- B. Best Management Practices Standard: FHWA FLP-94-005.
- C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
- E. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.
- F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- L. Open Water: Prevent standing water that could become stagnant.
- M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. Sustainable Design Documentation: Submit all submittals required in this section in accordance with procedures specified in Section 01 3329.
- C. Erosion and Sedimentation Control Plan:
 - 1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
 - 2. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - e. Other information required by law.
 - f. Format required by law is acceptable, provided any additional information specified is also included.
 - 3. Obtain the approval of the Plan by authorities having jurisdiction.
 - 4. Obtain the approval of the Plan by Owner.
- D. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- E. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 - 1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
 - 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D4491.
 - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
 - 4. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
 - 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
 - 6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
 - 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
- B. Silt Fence Posts: One of the following, minimum 5 feet long:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 INSTALLATION

- A. Silt Fences:
 1. Store and handle fabric in accordance with ASTM D4873/D4873M.
 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
 5. Install with top of fabric at nominal height and embedment as specified.
 6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
 7. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

3.04 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 2. Remove silt deposits that exceed one-third of the height of the fence.
 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Straw Bale Rows:
 1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 2. Remove silt deposits that exceed one-half of the height of the bales.
 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.05 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.

- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

**SECTION 01 6000
PRODUCT REQUIREMENTS**

PART 1

1.01 SCOPE

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
 - 1. Product standards and quality- substitutions
 - 2. Substitutions
 - 3. Manufacturer's directions
 - 4. Warranties
 - 5. Material delivery and responsibilities
 - 6. Protection
 - 7. Acceptance of equipment or systems
- B. It is the intent of the Specifications and Drawings to accomplish a complete and first-grade installation in which there shall be installed new materials and products of the latest and best design and manufacturer. Workmanship shall be thoroughly first-class and complete, executed by competent and experienced workmen.
- C. Equipment, specialties, and similar items shall be checked for compliance and fully approved prior to installation. Contractors are cautioned that work or equipment installed without approval is subject to condemnation, removal, and subsequent replacement with an approved item without extra remuneration.
- D. Related Work Specified Elsewhere:
 - 1. Section 00200 INSTRUCTIONS TO BIDDERS.
 - 2. Section 013300 SUBMITTAL PROCEDURES.
- E. Related Documents: The Work of this Section shall be included as a part of the Contract Documents of each Contractor or Subcontractor on this Project.
- F. Definitions:
 - 1. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self explanatory and have well recognized meanings in the construction industry.
 - a. "Products" are items purchased for incorporation in the Work, whether purchased for the project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - b. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.
 - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that require service, connections, such as wiring or piping.
- G. Quality Assurance:
 - 1. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
 - 2. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

- a. The Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of subcontractors.
 - b. If a dispute arises between contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.
- H. Product Delivery, Storage, and Handling:
- 1. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
 - a. Schedule delivery to minimize long term storage at the site and to prevent overcrowding of construction spaces.
 - b. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - c. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - d. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 - e. Store products on the site in a manner that will facilitate inspection and measurement of quality or counting of units.
 - f. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.
 - g. Store products subject to damage by elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2

2.01 MATERIALS

- A. Product Standards and Quality:
- 1. The Contract is based on the materials, equipment, and methods described in the Contract
 - a. Documents.
 - 2. Where in the Drawings and Specifications certain products, manufacturer's trade names, or catalog numbers are given, it is done for the expressed purpose of establishing a basis of quality, durability, and efficiency of design in harmony with the work outlined and is not intended for the purpose of limiting competition.
 - 3. The Architect will consider proposals for substitution of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Architect to evaluate the proposed substitution.
 - 4. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the Architect.
 - a. Refer to Section 00200 INSTRUCTIONS TO BIDDERS.
 - 5. Availability of Specified Items:
 - a. Verify prior to bidding that specified items will be available in time for installation during orderly and timely progress of the Work.
 - b. In the event specified item or items will not be so available, so notify the Architect prior to receipt of bids.
 - c. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back charged as necessary and shall not be borne by the Owner.

6. Voluntary Alternates: Bidders may, if they wish, submit materials and methods other than those described in these Contract Documents as voluntary alternates, provided that they are clearly identified and described on the Bid Form and that the Base Bid is based on materials and methods as described in the Contract Documents. Refer to Instructions To Bidders and Alternates: Section 01230.
 7. Where the questions of appearance, artistic effect, or harmony of design are concerned, the Architect reserves the right to refuse approval of substituted products proposed to be substituted for that specified, if in his opinion the item to be substituted is not harmonious to the finished effect and appearance desired, as portrayed in the Drawings and Specifications. The Architect's said refusal to approve, established by this paragraph, is final.
- B. Substitutions:
1. Substitutions: Changes in products, materials of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests of substitutions. The following are not considered to be requests for substitutions.
 - a. Substitutions requested during the bidding period, accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
 - b. Revisions to the Contract Documents requested by the Owner or Architect.
 - c. Specified options of products and construction methods included in the Contract Documents.
 - d. The Contractor's determination of and compliance with governing regulations and
 - e. orders issued by governing authorities.
 2. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record non-compliance with these requirements:
 - a. Extensive revisions to the Contract Documents are not required.
 - b. Proposed changes are in keeping with the general intent of the Contract Documents.
 - c. The request is timely, fully documented, and properly submitted.
 - d. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 - e. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
 - f. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 - g. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
 - h. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitutions provides the required warranty.
- C. Manufacturer's Directions:

1. Manufactured products shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the manufacturer's printed directions, unless herein specified to the contrary. Where manufacturer's printed directions are available and where reference is made to manufacturer's directions in the Specifications, the Contractor shall submit 2 copies of such directions to the Architect prior to the beginning of Work covered thereby.
 2. Where specific installation instructions are not part of these Specifications and Drawings, equipment shall be installed in strict accordance with instructions from the respective manufacturers. Where installation instructions included in these Specifications or Drawings are at a variance with instructions furnished by the equipment manufacturer, the Contractor shall make written request for clarification from the Architect.
 3. In accepting or assenting to the use of apparatus or material, or make, or arrangement thereof, the Architect in no way waives the requirements of these Specifications or the warranty embodied therein.
- D. Warranties:
1. Specific warranties or bonds called for in the Contract Documents, in addition to that falling under the general warranty as set forth in General Conditions, shall be furnished in accordance with the requirements of the Specifications.
 - a. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
 - b. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1) Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 2. Each Contractor shall and does hereby agree to warrant for a period of one year, or for longer periods, where so provided in the Specifications, as evidenced by the date of Substantial Completion issued by the Architect, products installed under the Contract to be of good quality in every respect and to remain so for periods described herein.
 3. Should defects develop in the aforesaid Work within the specified periods, due to faults in products or their workmanship, the Contractor hereby agrees to make repairs and do necessary Work to correct defective Work to the Architect's satisfaction, in accordance with the General and Supplementary Conditions. Such repairs and corrective Work, including costs of making good other Work damaged by or otherwise affected by making repairs or corrective Work, shall be done, within 14 days after written notice to the Contractor by the Owner, without cost to the Owner and at the entire cost and expense of the Contractor.
 - a. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
 - b. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
 4. Nothing herein intends or implies that the warranty shall apply to Work which has been abused or neglected or improperly maintained by the Owner or his

successor in interest.

5. Where service on products is required under this Article, it shall be promptly provided when notified by the Owner and no additional charge shall be made, unless it can be established that the defect or malfunctioning was-caused by abuse or accidental damage not to be expected under conditions of ordinary wear and tear.
 6. In the event movement in the adjoining structure or components causes malfunctioning, the Contractor responsible for the original installation of the adjoining structure or components shall provide such repair, replacement, or correction necessary to provide for proper functioning to bring the equipment back into the same operating condition as approved at the completion of the building.
 7. The manufacturer and supplier expressly warrants that each item of equipment furnished by him and installed in this Project is suitable for the application shown and specified in the Contract Documents and includes features, accessories, and performing characteristics listed in the manufacturer's catalog in force on the date bids are requested for the Work. This warranty is intended as an assurance by the manufacturer that his equipment is not being misapplied and is fit and sufficient for the service intended. This warranty is in addition to and not in limitation of other warranties or remedies required by law or by the Contract Documents. It shall be the responsibility of the Contractor for the particular equipment to obtain this warranty in writing.
 8. In case the Contractor fails to do Work so ordered, the Owner may have work done and charge the cost thereof against monies retained as provided for in the Agreement and, if said retained monies shall be insufficient to pay such cost or if no money is available, the Contractor and his Sureties shall agree to pay to the Owner the cost of such Work.
- E. Material Delivery and Responsibilities:
1. Contractor shall be responsible for materials he orders for delivery to the jobsite. Responsibility includes, but is not limited to, receiving, unloading, storing, protecting, and setting in place; ready for final connections.
 - a. The Owner will not be responsible for deliveries related to the construction or operation of the Contractor. The Owner cannot sign delivery forms for the Contractor.
 2. Contractors shall insure that products are delivered to the Project in accordance with the Construction Schedule of the project. In determining date of delivery, sufficient time shall be allowed for shop drawings and sample approvals, including the possibility of having to resubmit improperly prepared submittals or products other than those specified and the necessary fabrication or procurement time along with the delivery method and distance involved.
- F. Protection:
1. Each Contractor shall protect building elements and products when subject to damage. Should workmen or other persons employed or commissioned by one Contractor be responsible for damage, the entire cost of repairing said damage shall be assumed by said individual Contractor. Should damage be done by a person or persons not employed or commissioned by a Contractor, the respective Contractors shall make repairs and charge the cost to the guilty person or persons. The affected Contractors shall be responsible for collecting such charges. If the person or persons responsible for damage cannot be discovered, full and satisfactory repairs shall be made by the respective Contractor, and
 - a. the cost of Work shall be prorated against the Contractor.
 2. The respective Contractors shall protect their products prior to installation and final acceptance. Storage shall be dry, clean, and safe. Materials or equipment damaged, deteriorated, rusted or defaced due to improper storage, shall be repaired, refinished, or replaced, as required by the Architect. Products lost through theft or mishandling shall be replaced by the Contractor without cost to

the Owner.

G. Acceptance of Equipment or Systems:

1. The Owner will not accept the start of the warranty period on systems or equipment until Substantial Completion notice is issued by the Architect to the Contractor releasing Owner's occupancy of the building, in part or whole. Each Contractor shall make such provisions as required to extend the manufacturer's warranty from time of initial operation of systems or equipment until written notice of Substantial Completion is received.

END OF SECTION 016000

**SECTION 01 6116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. VOC restrictions for product categories listed below under "DEFINITIONS."
- D. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 3515 - LEED Certification Procedures.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Flooring.
 - 4. Composite wood.
 - 5. Products making up wall and ceiling assemblies.
 - 6. Thermal and acoustical insulation.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
- C. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
- D. Interior of Building: Anywhere inside the exterior weather barrier.
- E. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- F. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- G. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Clay brick.
 - 3. Metals that are plated, anodized, or powder-coated.
 - 4. Glass.
 - 5. Ceramics.
 - 6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings 2005 (Reapproved 2018).
- C. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
- D. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.
- E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2007.
- F. CRI (GLCC) - Green Label Testing Program - Approved Product Categories for Carpet Cushion; Carpet and Rug Institute; Current Edition.
- G. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.
- H. GreenSeal GS-11 - Paints; Green Seal, Inc.; 1993.
- I. GreenSeal GS-36 - Adhesives for Commercial Use 2013.
- J. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).
- K. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).
- L. SCS (CPD) - SCS Certified Products Current Edition.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Evidence of Compliance: Submit for each different product in each applicable category.
- C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

- A. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Joint Sealants: SCAQMD 1168 Rule.
 - 3. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).

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- B. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current GREENGUARD Children & Schools certification; www.greenguard.org.
 - b. Current SCS Indoor Advantage Gold certification; www.scs-certified.com.
 - c. Product listing in the CHPS Low-Emitting Materials Product List at www.chps.net/manual/lem_table.htm.
 - d. Current certification by any other agencies acceptable to CHPS.
 - e. Report of laboratory testing performed in accordance with CHPS requirements for getting a product listed in the Low-Emitting Materials Product List; report must include laboratory's statement that the product meets the specified criteria.
 - 2. Product data submittals showing VOC content are NOT acceptable forms of evidence.
- C. Paints and Coatings: Provide products having VOC content as specified in Section 09 9000.
- D. Carpet Cushion: Provide products having VOC content not greater than that required for CRI Green Label certification.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current Green Label Certification.
 - b. Report of laboratory testing performed in accordance with requirements.
- E. Composite Wood and Agrifiber Products and Adhesives Used for Laminating Them: Provide products having no added urea-formaldehyde resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Published product data showing compliance with requirements.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

**SECTION 01 6300
SUBSTITUTIONS AND PRODUCT OPTIONS**

SCOPE

1.01 RELATED REQUIREMENTS:

- A. Section 00200 INSTRUCTIONS TO BIDDERS: Article entitled SUBSTITUTIONS AND APPROVALS DURING BIDDING.
 - 1. Conditions of the Contract.
 - 2. Section 011000 SUMMARY OF WORK.
- B. Standards and Named Products:
 - 1. The naming of products and materials is done for the express purpose of establishing a basis of durability, efficiency, appearance and simplification of maintenance and not for the purpose of limiting competition. Other manufacturer's materials or articles may be used providing the material or article is presented to and approved by the Architect, subject to conditions hereinafter described.
 - 2. Payment for changes in the work of others which are occasioned by substitutions shall be included as part of the substitution.
 - 3. Proposals for substitutions will be considered only if said proposals increase the quality of the project, decrease the expenditure on the part of the Owner or are clearly superior to the products, materials, equipment, and methods specified herein. Proposals must be submitted using the "Substitution Request Form" contained herein. Proposals for substitutions which appear to be submitted only to decrease the expenditures on the part of the Contractor without a corresponding proposal for a reduction in the contract amount will not be entertained.
 - 4. If a substitution is proposed resulting from availability problems with specified materials, proposals should also include consideration for modifications to the contract amount on behalf of the Owner. No request for an extension of the time of completion will be entertained by the Architect if such an extension is a result of the Contractor's lack of knowledge of the availability of the specified items.
 - 5. All substitution requests shall address the following issues as a minimum for consideration:
 - a. Provide complete manufacturer's product information as required by Section 01330 SUBMITTAL PROCEDURES.
 - b. List the specified product which is to be substituted.
 - c. If the product is equal to that specified, state the proposed credit to the +Owner.
 - d. If the product is superior to that specified, explain in detail the advantages as well as any disadvantages.

END OF SECTION 016300

**SECTION 01 6500
STARTING OF SYSTEMS**

SCOPE

1.01 SECTION INCLUDES:

- A. Starting systems.
 - 1. Demonstration and instructions.
- B. Starting Systems:
 - 1. Coordinate schedule for start-up of various equipment and systems.
 - 2. Notify Architect, and Owner seven (7) days prior to start-up of each item.
 - 3. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
 - 4. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 - 5. Verify wiring, controls and support components for equipment are complete and tested.
 - 6. Execute start-up under supervision of Contractor's personnel in accordance with manufacturers' instructions and recommendations.
 - 7. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
 - 8. Submit a written report that equipment or system has been properly installed and is functioning correctly.
- C. Demonstration and Instructions:
 - 1. Demonstrate operations and maintenance of products to Owner's personnel at least two weeks prior to date of final inspection.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
 - 3. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
 - 4. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.
 - 5. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
 - 6. Video record all demonstrations, including questions and answers. Provide Owner with copy in VHS or DVD format.
- D. Instructional Video Tapes/DVDs:
 - 1. Submit instructional video tapes/DVDs as part of close-out documents.
 - 2. Provide a video tape/DVD for each mechanical and electrical system including but not limited to boilers, air handling units and fan powered boxes, temperature control system, electrical panels, fire riser equipment and fire pumps, emergency generator, and fire alarm system, and as otherwise indicated in the documents wherever demonstration of equipment is required.
 - 3. Label and index all demonstrations on video tape/DVD. Provide comprehensive index of all video tapes/DVDs in close-out binder.
 - 4. A manufacturer's pre-recorded video tape/DVD may be substituted for the demonstration video/DVD.

END OF SECTION 16500

SECTION 01 7000 EXECUTION

PART 1

1.01 SCOPE

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction Layout.
 - 2. Field Engineering and Surveying.
 - 3. Geotechnical/Soils Inspection/Sampling
 - 4. General Installation
 - 5. Coordination of Owner-Installed Products.
 - 6. Progress Cleaning.
 - 7. Starting and Adjusting Equipment
 - 8. Protection of Installed Construction.
 - 9. Correction of the Work.
- B. Job Requirements: Immediately on discovery of the need for clarification of the Contract Documents, Contractor shall submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Do not overlook the requirements for the Certified Progress Surveys and the Final Property Survey.
- C. Existing Condition Verification: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work. Verify the location and points of connection of utility services. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction that may affect the Work. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services. Furnish location data for work related to Project that must be performed by public utilities serving Project site. Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction. Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.02 CONSTRUCTION LAYOUT

- A. Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
 - 1. Engage a land surveyor to lay out the Work using accepted surveying practices.
 - a. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - b. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - c. Inform installers of lines and levels to which they must comply.
 - d. Check the location, level and plumb, of every major element as the Work progresses.

- e. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- 2. Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- 3. Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations
- 4. Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, and weather conditions

PART 3

2.01 FIELD ENGINEERING AND SURVEYING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Progress Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework. Submit four (4) copies to the Architect, showing the work performed. Record survey data.

2.02 PART 4

2.03 GEOTECHNICAL / SOILS INSPECTION / SAMPLING

- A. The soils engineer shall be on site to review cut and fill procedures to review and verify that existing soil composition is consistent with soils report and that attained compaction levels are in compliance with the specified requirements.
 - 1. Perform soil inspections during construction of building pad and foundation excavations.
 - 2. Should conditions vary from the soils report, the soils engineer shall notify the Architect immediately and render a recommendation on how best to proceed,
 - 3. Promptly notify Architect of irregularities or deficiencies in the work which are observed during performance of duties
 - 4. Promptly submit one copy of the report of inspections and test data to the Architect, submit two copies of those reports to the Contractor at the project site, and submit a single copy to the Owner.

2.04 PART 5

2.05 INSTALLATION

- A. Acceptance of Conditions: Examine substrates, areas, and conditions, with installer or applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
- B. Location: 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.
- C. Compliance: Comply with manufacturer's written instructions and recommendations for installing products in applications indicated. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Protection: 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.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 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 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
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

2.06 PART 6

2.07 OWNER-INSTALLED PRODUCTS

- A. Provide access to Project site for Owner's construction forces and coordinate construction and operations of the Work with work performed by Owner's construction

forces as required.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

2.08 PART 7

2.09 PROGRESS CLEANING

- A. Clean site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - a. Remove liquid spills promptly.
 - b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate
 2. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
 3. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
 4. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
 5. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

2.10 PART 8

2.11 STARTING AND ADJUSTING EQUIPMENT

- A. Starting: Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjusting: Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Testing: Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements.

2.12 PART 9

2.13 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion. Comply with manufacturer's

written instructions for temperature and relative humidity

PART 10

3.01 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements for "Cutting and Patching." Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Restore permanent facilities used during construction to their specified condition. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired. Remove and replace chipped, scratched, and broken glass or reflective surfaces.
- B.

3.02 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
 - 2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
 - 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and []): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

- a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
- b. See Section 01 1000 for other limitations on outages and required notifications.
- c. Provide temporary connections as required to maintain existing systems in service.
- 4. Verify that abandoned services serve only abandoned facilities.
- 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 - 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 - 3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
 - 4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
 - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

END OF SECTION 017000

**SECTION 01 7200
PROJECT RECORD DOCUMENTS**

PART 1

1.01 SCOPE

- A. At the site, maintain a "Project Record" copy of each of the following for Architect's and Owner's use:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Architect field orders or written instructions.
 - 6. Approved shop drawings, product data and samples.
 - 7. Field test records.
 - 8. Third Party Inspection Reports
 - 9. Label each document "PROJECT RECORD" in neat, large printed letters.
- B. Job Requirements: At contract close-out, deliver to the Architect (for the Owner) electronic format of as-builts of all sheets of the Contract Documents which have been corrected (by Contractor) to indicate all changes along with one Project Manual including addenda which have been corrected by Contractors to indicate all changes. Cost of reproducible mylars or sepias shall be borne by the General Contractor. All corrections shall be made using the same quality of linework, lettering, symbols, etc., as appears on the original Contract Documents.

PART 2

2.01 RECORDING

- A. Record information concurrently with construction progress. Do not physically conceal any Work until required information is recorded.
 - 1. Drawings: Legibly mark to record actual construction.
 - a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - b. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
 - c. Field changes of dimension and detail.
 - d. Changes made by Field Order or by Change Order.
 - e. Details not on original Contract Drawings.
 - 2. Specifications and Addenda: Legibly mark each section to record:
 - a. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
 - b. Changes made by Field Order or by Change Order.

END OF SECTION 017200

**SECTION 01 7400
WARRANTIES AND BONDS**

PART 1

1.01 SCOPE

- A. Unless otherwise specified in respective specificatin section the General Contractor shall warrant all materials and workmanship for a period of 12 months beginning at the date of Substantial Completion or Permission to Occupy.
 - 1. Any defective materials or workmanship shall be corrected or replaced without cost to the Owner during the warranty period.
- B. This section covers furnishing two (2) copies of all warranties and bonds as part of the close-out requirements.
 - 1. Related Requirements:
 - a. Section 017300 OPERATIONS AND MAINTENANCE DATA.
 - b. Each Specification Section: Warranties and bonds required for specific products or work.

PART 2

2.01 FORM OF SUBMITTALS

- A. Bind in commercial quality 8-1/2" x 11" three-ring side binders with durable and cleanable plastic covers.
- B. Label cover of each packet with typed or printed title "WARRANTIES AND BONDS", with title of project, name, address and telephone number of Contractor, and name of responsible principal.
- C. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the project manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- D. Separate each warranty or bond with index tab sheets, keyed to the Table of Contents listing. Provide full information, using separate type sheet as necessary.
 - 1. Subcontractor, supplier and manufacturer, with name, address and telephone number of responsible principal.
 - 2. Date of beginning and duration of warranty or bond.
 - 3. Scope of responsibilities.
 - 4. Instances which might affect the validity of warranty or bond.
 - 5. Owner's procedures in the event of failure of product or work.

PART 3

3.01 PREPARATION OF SUBMITTALS

- A. Obtain warranties and bonds, executed in duplicate by responsible subcontractor, suppliers and manufacturers, within ten days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave data of beginning of time of warranty until the date of substantial completion is determined. Verify that documents are in proper form, full information is provided, and notarized. Co-execute submittals.

3.02 PART 4

3.03 TIME OF SUBMITTALS

- A. Make submittals within ten days after date of Substantial Completion, prior to final application for payment.
- B. For items of work when acceptance is delayed beyond date of Substantial Completion, submit within ten days after acceptance by Architect, listing the date of acceptance as the beginning of the warranty period

END OF SECTION 017400

**SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- E. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- F. The following sources may be useful in developing the Waste Management Plan:
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Sustainable Design Documentation: Submit Waste Management Plan and Waste Disposal Reports in accordance with procedures specified in Section 01 3329.
- C. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - 2. Submit Report on a form acceptable to Owner.
 - 3. Landfill Disposal: Include the following information:
 - a. Identification of material.

- b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Incinerator Disposal: Include the following information:
- a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
5. Recycled and Salvaged Materials: Include the following information for each:
- a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
- a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Prebid meeting.

2. Preconstruction meeting.
 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
1. Provide containers as required.
 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

**SECTION 01 7800
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Individual Product Sections: Specific requirements for operation and maintenance data.
- C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site two sets of the following record documents to be provided to the owner; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Addenda.
 - 3. Change Orders and other modifications to the Contract.
 - 4. Reviewed shop drawings, product data, and samples.
 - 5. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.

- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Contract drawings.
 - 3. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - a. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - 1) Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - 2) Accurately record information in an understandable drawing technique.
 - 3) Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - b. Content: Types of items requiring marking include, but are not limited to, the following:
 - 1) Dimensional changes to Drawings.
 - 2) Revisions to details shown on Drawings.
 - 3) Depths of foundations below first floor.
 - 4) Locations and depths of underground utilities.
 - 5) Revisions to routing of piping and conduits.
 - 6) Revisions to electrical circuitry.
 - 7) Actual equipment locations.
 - 8) Duct size and routing.
 - 9) Locations of concealed internal utilities.
 - 10) Retain Work Change Directive in first subparagraph below if using EJCDC Document 1910-8.
 - 11) Changes made by Change Order or Construction Change Directive.
 - 12) Changes made following Architect's written orders.
 - 13) Details not on the original Contract Drawings.
 - 14) Field records for variable and concealed conditions.
 - 15) Record information on the Work that is shown only schematically.
 - c. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - d. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - e. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - f. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- F. Record Specifications:
 - 1. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 3. Delete two subparagraphs below if provisions are too elaborate, or revise to suit Project.

4. Retain first subparagraph below with or without subparagraph above, where this record is desired.
 - a. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 - b. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- G. As Built Survey:
 1. General Contractor shall be responsible for contracting with surveying company to complete an as built survey to document final construction and site conditions.
 2. Survey requirements shall meet ALTA standards: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
- H. Record Product Data:
 1. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - b. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - c. If possible, a Change Order proposal should include resubmitting updated Product Data. This eliminates the need to mark up the previous submittal.
 - d. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
 - 2.

3.02 OPERATION AND MAINTENANCE DATA

- A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- B. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- C. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.
- E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 1/2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- L. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- M. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
- N. In addition to hard printed copies of all instruction manuals provide same information digitally to the owner on CD or DVD in standard software format. Clearly label contents of each disk.

3.06 WARRANTIES AND BONDS

- A. Unless otherwise specified in respective specification section the General Contractor and each Subcontractor shall warrant all materials and workmanship for a period of 12 months beginning at the date of Substantial Completion or Permission to Occupy.
 - 1. Any defective materials or workmanship shall be corrected or replaced without cost to the Owner during the warranty period.
- B. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- C. Verify that documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Retain warranties and bonds until time specified for submittal.
- F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

**SECTION 01 7823
OPERATING AND MAINTENANCE DATA**

PART 1

1.01 SCOPE

- A. This section covers furnishing two (2) hard copies and two (2) electronic copies of Operating and Maintenance Data as part of the Close-Out Requirements.

PART 2

2.01 CONTENT AND FORMAT

- A. Provide bound operations and maintenance data manuals covering all systems, equipment and materials as installed. Manuals shall contain the following:
1. Diagrams of all systems, including temperature control system.
 2. Approved equipment drawings and data clearly marked for equipment furnished.
 3. Complete operating and maintenance instructions for each system and item of equipment, setting forth in detail and step-by-step the procedure for starting, stopping, operating and maintaining the entire system as installed.
 4. Exploded view and a parts list of all items of equipment.
 5. A complete valve tag list including the name and function of the pipe in which the valve is mounted.
 6. Any special emergency operating instructions and a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.
 7. A certified log of air quantities at all air supply, return and exhaust openings as approved by the Architect.
 8. ASME and State pressure vessel inspection forms.
 9. All motor data, including standard and actual operating in service data.
 10. Manufacturer's equipment guarantees.
 11. Complete maintenance instructions for all materials installed, i.e., flooring, wall coverings, windows, builders hardware, etc.
- B. Provide, in a separately indexed section of the manual, a complete comprehensive schedule of maintenance intervals for each system and each piece of equipment installed requiring any periodic maintenance, i.e., daily, bi-weekly, or bi-monthly, monthly, quarterly, semi-annually and annually. Include in the manual a schedule of filters, to include size, media type, cleaning interval, listed by A.H.U. No. and location.
- C. Instruct the Owner or his selected representatives (via demonstration) as to the proper care and maintenance of each system, item of equipment and materials and provide signed acknowledgment from personnel receiving such instruction in the bound manuals following the data for that system or item.
- D. Hard-copy Manuals shall be loose leaf with fiberboard covers. Each sheet shall be reinforced to prevent tearing from continued use, and each manual shall have the following information clearly printed on its cover:
1. Project name, name of Owner and address.
 2. Name and address of Architect.
 3. Contractor and Subcontractor names, addresses, department to contact and telephone numbers, including night and emergency numbers.
 4. Supplier names and telephone numbers.
 5. Name and telephone number of manufacturer's authorized representative.
- E. Electronic Manuals shall be supplied by CD submittal, containing all information in PDF or CAD format. CD shall be organized and contain an index of information. Each electronic manual shall have the following information printed on its cover:
1. Project name, name of Owner and address
 2. Name and address of Architect.

3. Contractor and Subcontractor names, addresses, department to contact and telephone numbers, including night and emergency numbers.
- F. Job Requirements: Operating and maintenance data submittals shall be reviewed by the Architect prior to authorizing release of final retainage at completion and shall be updated to include additions, changes and acknowledgments which shall be approved by the Architect prior to authorizing final payment.
- G. Attic Stock: General Contractor to supply the following as attic stock at the conclusion of the project:
1. One (1) box of window screens 0 must provide a minimum of 3 screens for each window type.
 2. All unused paint and flooring materials to be left onsite - materials must be clearly labeled.
 3. Two (2) sinks, faucets, and water closets of each type provided.
 4. Two (2) sets of bath accessories provided in apartments and one (1) set of bath accessories provided.
 5. One (1) box of replacement light bulbs -- must provide a minimum of 6 bulbs for each fixture/bulb type.
 6. One (1) box of replacement filters for all HVAC equipment.
 7. One (1) box of replacement ACT ceiling tiles.
 8. Two (2) VTAC units - when applicable.
 9. One (1) set of kitchen appliances - refrigerator, range, range hood and microwave.
 10. Two (2) garbage disposals - when applicable.
 11. Two (2) apartment bathroom exhaust fans.
 12. Two (2) apartment thermostats.
 13. One (1) common area thermostat - minimum of 1 per each type.
 14. One (1) LH and RH apartment entry door.
 15. Two (2) sets of apartment and common area door hardware - minimum of 2 per each type.
 16. One (1) set of apartment lighting fixtures - minimum of 1 per each type.
 17. One (1) set of common area light fixtures - minimum of 1 per each type.

END OF SECTION 017823

**SECTION 01 7900
DEMONSTRATION AND TRAINING**

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Conveying systems.
 - 6. Landscape irrigation.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Items specified in individual product Sections.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
 - 1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
 - 2. Submit one copy to the Commissioning Authority, not to be returned.
 - 3. Make commissioning submittals on time schedule specified by Commissioning Authority.
 - 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.
- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Commissioning Authority for review and inclusion in overall training plan.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.

- D. Training Reports:
 1. Identification of each training session, date, time, and duration.
 2. Sign-in sheet showing names and job titles of attendees.
 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
 4. Include Commissioning Authority's formal acceptance of training session.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 1. Format: DVD Disc.
 2. Label each disc and container with session identification and date.

1.03 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum two hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by Contractor.
 - 11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 018113

SUSTAINABILITY DESIGN REQUIREMENTS

Beechwood Apartments

PART 1 GENERAL

GENERAL CONDITIONS

- A. The General Conditions, Modifications to General Conditions, Supplementary or Special Conditions and any Instructions to Bidders shall apply to all Divisions of work.
- B. The requirements of State, Local or appropriate codes applicable to the work, whichever is the most stringent is a requirement of all Divisions of work.

WORK OF THIS SECTION

- A. Section includes:
 - 1. Sustainable Project Goals:**
 - a. Applicants must obtain a sustainable building certification - **National Green Building Standard (NGBS)**, meeting Silver level or higher for single and multifamily buildings, both new and renovation.
- B. Contractor shall coordinate work and requirements with Owner Contracted Green Rater/Verifier for Green certifications. Pertinent to green certifications the role of the Green Rater/Verifier is to guide the construction team with certification process; review documentation, verify green requirements are met; and to perform third-party testing.

REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - 2. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
 - 3. ASHRAE 90.1 - Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
 - 4. ASHRAE 129 - Measuring Air-Change Effectiveness.
- B. ASTM International:
 - 1. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
 - 2. ASTM E903 - Standard Test Method for Solar Absorption, Reflectance, and Transmittance of Materials Using Integrating Spheres.
- C. Bay Area Air Quality Management District: BAAQMD Regulation 8, Rule 51 - Adhesive and Sealant Products.
- D. Carpet and Rug Institute: CRI Green Label Testing Program.
- E. Forest Stewardship Council: FSC Guidelines- Forest Stewardship Council Guidelines.
- F. Green Seal: GS-11 - Product Specific Environmental Requirements.
- G. Sheet Metal and Air Conditioning Contractors: SMACNA IAQ - IAQ Guidelines for Occupied Buildings under Construction.
- H. South Coast Air Quality Management District: SCAQMD Rule 1168 - Adhesive and Sealant Applications.
- I. U.S. Environmental Protection Agency:
 - 1. EPA 832-R-92-005 - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
 - 2. EPA Baseline IAQ - Testing for Indoor Air Quality, Baseline IAQ, and Materials Section 01445.
 - 3. EPA 402-K-01-002 – A Step-by-Step Guide on how to Build Radon-Resistant Homes
- J. Home Innovation Research Lab's (HIRL)'s
 - 1. ICC/ASHRAE 700 National Green Building Standard (NGBS)

- K. ENERGY STAR Qualified Homes Program Requirements
https://www.energystar.gov/sites/default/files/ES%20NPR%20v85%202018-05-16_clean.pdf

SUBMITTALS

- A. The contractor shall submit the following items directly to the Green Rater/Verifier.

QUALITY ASSURANCE

1. Perform work in accordance with ICC/ASHRAE 700 National Green Building Standard
2. Maintain one copy of NGBS Builder Resource Guide on site. Document is available for download at
https://www.homeinnovation.com/services/certification/green_homes/multifamily_certification/multifamily_home_certification_process
3. Perform storm water management and erosion control Work in accordance with EPA Best Management Practices or local erosion and sedimentation control standards whichever is more stringent.
4. Perform ventilation Work in accordance with ASHRAE 62.

PART 2 PRODUCTS

PRODUCT SUBSTITUTION

- A. Thoroughly review any requests for substitution for products that are related to Green Communities prerequisites and credits. Any substitutions may jeopardize the project's ability to obtain certification.

PART 3 EXECUTION

NATIONAL GREEN BUILDING STANDARD (NGBS)

- A. Perform work in accordance with ICC/ASHRAE 700 National Green Building Standard for mandatory and optional provisions pertinent to this project listed in NGBS worksheet included at the end of this section.
- B. Thoroughly review any requests for substitution for products that are related to NGBS prerequisites and credits. Any substitutions may jeopardize projects' ability to obtain certification.

PERFORMANCE TESTING & INSPECTIONS

- C. Minimum envelope leakage – where applicable: the following areas of building envelope and demising walls shall be sealed, caulked, gasketed, or weather-stripped to minimize envelope leakage:
 1. Joints around exterior doors and windows.
 2. Joints between walls and foundation; between conditioned spaces and attics, demising walls, crawl spaces and garage.
 3. Top plates and bottom plates shall be sealed at all locations.
 4. Minimize thermal bridging per Energy Star Version 3 Thermal Enclosure System Rater Checklist
 5. All mechanical, plumbing and electrical penetrations in exterior and demising walls. Mechanical chase shall be sealed at crawl space ceiling.
 6. Exterior sheathing and house wrap.
 7. Minimize entry of air from outside, attic, garage, and crawl space into exterior wall and interior wall cavities to ensure passing of air infiltration test. Also minimize air transfer from unit to unit, and unit to corridor.

8. Batt insulation shall be stapled to face of stud to ensure full contact of insulation with face of drywall. Cut insulation around all mechanical, plumbing and electrical work.
9. Seal all duct boots in floors to subfloors and seal all duct boots in walls to drywall.
10. Seal gaps between drywall and all duct penetrations in ceilings, including exhaust fans.

**TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION**

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jams and framing, and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors (including above garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in inverted crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls.
Shafts, penetrations	Duct shafts, utility penetrations, and fire shafts opening to exterior or unconditioned space shall be sealed.	
Narrow cavities		Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring		Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Showers/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air-sealed boxes shall be installed.	
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	

1. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

D. Thermal Bypass Inspection - The Green Rater will conduct a visual Thermal Bypass Inspection to inspect proper installation and continuity of thermal insulation and air-tightness of envelope. This inspection must take place after exterior envelope insulation has been installed, but prior to and installation of any drywall. One inspection per floor shall be

conducted. If additional inspections are deemed necessary due construction sequencing, Contractor shall notify the Architect and Green Verifier immediately. Contractor shall schedule the inspection with no less than two week notice to the Green Verifier. Contractor shall provide access to each unit and cooperate with conducting of the test. Additional inspections necessary due to incomplete work shall be back-charged to the Contractor. A sample Thermal Bypass Inspection Checklist is enclosed in section 018113.

- E. Final Inspections - Upon substantial completion and prior to occupancy, the Green Verifier will conduct a visual Final Inspection to verify green requirements incorporated in the project. The contractor shall notify the Green Rater at least four (4) weeks prior to the anticipated date for such inspection. Contractor shall provide access to each unit and cooperate with conducting of the test. Additional inspections necessary due to incomplete work shall be back-charged to the Contractor.
- F. Third-Party Testing - Third-party Testing is to be scheduled and conducted in conjunction with the final inspection. The contractor shall notify the Green Verifier at least four (4) weeks prior to the anticipated date for such inspection. Contractor shall provide access to each unit and cooperate with conducting of the test.

Following tests shall be conducted by Green Verifier:

1. Air Infiltration Test (Blower door Test) – Mandatory – Measures air leakage through unit enclosure such as exterior walls, demising walls, ceilings, chases, etc.
2. Distribution Loss Test (Duct Blaster Test) – Mandatory – Measures leakage through the mechanical distribution system

ENCLOSURES

- A. National Green Building Standard (NGBS) worksheet

END OF SECTION 018113

Chapter
Points
R/F

Goal Level:	Silver
Overall Points: 168,	Overall Level: Silver
Points: Ch5: 58, Ch6: 45, Ch7: Silver, Ch8: Silver, Ch9: 47, Ch10: 18	
Report Phase:	Final



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Home Address:
Community/Lot #:

Practice #	Practice	Points Available	Points Claimed	Points Awarded	Status
11.501 LOT SELECTION					
5 P RF	11.501.2	11.501.2 Multi-modal transportation. A range of multi-modal transportation choices are promoted by one or more of the following:			
5 P RF	(1)	The building is located within one-half mile (805 m) of pedestrian access to a mass transit system.			
		6	6	6	<input checked="" type="checkbox"/>
5 P RF	(2)	The building is located within five miles (8,046 m) of a mass transit station with provisions for parking.			
		3	3	3	<input checked="" type="checkbox"/>
5 P RF	(3)	The building is located within one-half mile (805 m) of six or more community resources. No more than two each of the following use category can be counted toward the total: Recreation, Retail, Civic, and Services. Examples of resources in each category include, but are not limited to the following:			
5 P RF		Recreation: recreational facilities (such as pools, tennis courts, basketball courts), parks.			
5 P RF		4	4	4	<input checked="" type="checkbox"/>
5 P RF		Retail: grocery store, restaurant, retail store.			
5 P RF		Civic: post office, place of worship, community center.			
5 P RF		Services: bank, daycare center, school, medical/dental office, Laundromat/dry cleaners.			
5 P RF		NOTE: List the 6 community resources in the Notes field.			
5 P RF		OR			
11.502 PROJECT TEAM, MISSION STATEMENT, AND GOALS					
5 P RF	11.502.1	11.502.1 Project team, mission statement, and goals. A knowledgeable team is established and team member roles are identified with respect to green lot design, preparation, and development.			
5 P RF		The project's green goals and objectives are written into a mission statement.			
		4	4	4	<input checked="" type="checkbox"/>
11.503 LOT DESIGN					
5 P R	11.503.1	11.503.1 Natural resources. Natural resources are conserved by one or more of the following:			
5 P R	(4)	Basic training in tree or other natural resource protection is provided for the on-site supervisor.			
		4	4	4	<input checked="" type="checkbox"/> TRUE
5 P R	(5)	All tree pruning on-site is conducted by a certified arborist or other qualified professional.			
		3	3	3	<input checked="" type="checkbox"/> TRUE
11.504 LOT CONSTRUCTION					
5 P RF	11.504.3	11.504.3 Soil disturbance and erosion implementation. On-site soil disturbance and erosion during remodeling are minimized by one or more of the following in accordance with the SWPPP or applicable plan: (also see Section 11.503.3)			
5 P R	(1)	Sediment and erosion controls are installed on the lot and maintained in accordance with the stormwater pollution prevention plan, where required.			
		5	5	5	<input checked="" type="checkbox"/> TRUE
5 P RF	(7)	Soil is improved with organic amendments or mulch.			
		3	3	3	<input checked="" type="checkbox"/>
11.505 INNOVATIVE PRACTICES					
5 P F	11.505.1	11.505.1 Driveways and parking areas. Driveways and parking areas are minimized or mitigated by one or more of the following:			
5 P F	(2)	In a multifamily project, parking capacity does not exceed the local minimum requirements.			
		5	5	5	<input checked="" type="checkbox"/>
5 P RF	11.505.3	11.505.3 Density. The average density on the lot on a net developable area basis is:			
5 P RF	(1)	7 to less than 14 dwelling units per acre (per 4,047 m ²)			
		4	8	8	(5)
5 P RF	(2)	14 to less than 21 dwelling units per acre (per 4,047 m ²)			
		5			
5 P RF	(3)	21 to less than 35 dwelling units per acre (per 4,047 m ²)			
		6			
5 P RF	(4)	35 to less than 70 dwelling units per acre (per 4,047 m ²)			
		7			
5 P RF	(5)	70 or greater dwelling units per acre (per 4,047 m ²)			
		8			
5 P F	11.505.9	11.505.9 Smoking prohibitions. Signs are provided on multifamily and mixed-use lots prohibiting			
5 P F	(a)	Smoking is prohibited within 25 feet (7.5 m) of all building exterior doors and operable windows or building air intakes within 15 (4.5 m) vertical feet of grade or a walking surface.			
		3	3	3	<input checked="" type="checkbox"/>
5 P F	(b)	Smoking is prohibited on decks, balconies, patios and other occupied exterior spaces.			
		3	3	3	<input checked="" type="checkbox"/>
5 P F	(c)	Smoking is prohibited at all parks, playgrounds, and community activity or recreational spaces.			
		3	3	3	<input checked="" type="checkbox"/>
5 P F		11.505.10 Exercise & Recreation Area. For multifamily buildings, on-site dedicated recreation space for exercise or play opportunities for adults and/or children open and accessible to residents			

11.601 QUALITY OF CONSTRUCTION MATERIALS AND WASTE							
6 P R	11.601.1	11.601.1 Conditioned floor area. Finished floor area of a dwelling unit or sleeping unit after the remodeling is limited. Finished floor area is calculated in accordance with ANSI Z765 for single family and ANSI/BOMA Z65.4 for multifamily buildings. Only the finished floor area for stories above grade plane is included in the calculation.		14	14		
6 P R	(1)	less than or equal to 700 square feet (65 m ²)		14			
6 P R	(2)	less than or equal to 1,000 square feet (93 m ²)		12			
6 P R	(3)	less than or equal to 1,500 square feet (139 m ²)		9			
6 P R	(4)	less than or equal to 2,000 square feet (186 m ²)		6			
6 P R	(5)	less than or equal to 2,500 square feet (232 m ²)		3			
6 P R	(6)	greater than 4,000 square feet (372 m ²)		N/A			
6 P R		(For every 100 square feet (9.29 m ²) over 4,000 square feet (372 m ²), one point is to be added the threshold points shown in Table 305.3.7 for each rating level.)					
6 P R	11.601.6	11.601.6 Stacked stories. Stories above grade are stacked, such as in 1½-story, 2-story, or greater structures. The area of the upper story is a minimum of 50 percent of the area of the story below based on areas with a minimum ceiling height of 7 feet (2,134 mm).		8 Max	8	8	from overview: 4+ story bldg.
6 P R	(1)	first stacked story		4			
6 P R	(2)	for each additional stacked story		2			
11.602 ENHANCED DURABILITY AND REDUCED MAINTENANCE							
6 P RF	11.602.1	11.602.1 Moisture Management – Building Envelope					
6 P R	11.602.1.1	11.602.1.1 Capillary breaks					
6 P R	11.602.1.1.1	11.602.1.1.1 Capillary breaks A capillary break and vapor retarder are installed at concrete slabs in accordance with ICC IRC Sections R506.2.2 and R506.2.3 or ICC IBC Sections 1907 and 1805.4.1.		Mandatory			Met
6 P R		This practice is not mandatory for existing slabs without apparent moisture problem.					
6 P R	11.602.1.3	11.602.1.3 Foundation drainage					
6 P RF	11.602.1.7	11.602.1.7 Moisture control measures					
6 P R	11.602.1.7.1	11.602.1.7.1 Moisture control measures are in accordance with the following:					
6 P R	(1)	Building materials with visible mold are not installed or are cleaned or encapsulated prior to concealment and closing.		2	2	2	<input checked="" type="checkbox"/> TRUE
6 P R	(2)	Insulation in cavities is dry in accordance with manufacturer's instructions when enclosed (e.g., with drywall).		Mandatory 2	0	0	N/A
6 P R		NOTE: If "N/A" is selected, explain why in the assigned Notes area.					
6 P R	11.602.1.8	11.602.1.8 Water-resistive barrier. Where required by the ICC, IRC, or IBC, a water-resistive barrier and/or drainage plane system is installed behind newly installed exterior veneer and/or siding and where there is evidence of a moisture problem.		Mandatory			N/A
6 P R		NOTE: If "N/A" is selected, explain why in the assigned Notes area.					
6 P R	11.602.1.9	11.602.1.9 Flashing. Flashing is provided as follows to minimize water entry into wall and roof assemblies and to direct water to exterior surfaces or exterior water-resistive barriers for drainage. Flashing details are provided in the construction documents and are in accordance with the fenestration manufacturer's instructions, the flashing manufacturer's instructions, or as detailed by a registered design professional.					
6 P R		Points awarded only when practices (2)-(7) are implemented in all newly installed construction and not less than 25 percent of the applicable building elements for the entire building after the remodel.					
6 P R	(1)	Flashing is installed at all of the following locations, as applicable:					Met
6 P R	(a)	around exterior fenestrations, skylights, and doors					
6 P R	(b)	at roof valleys					
6 P R	(c)	at all building-to-deck, -balcony, -porch, and -stair intersections					
6 P R	(d)	at roof-to-wall intersections, at roof-to-chimney intersections, at wall-to-chimney intersections, and at parapets					
6 P R	(e)	at ends of and under masonry, wood, or metal copings and sills					
6 P R	(f)	above projecting wood trim					
6 P R	(g)	at built-in roof gutters, and					
6 P R	(h)	drip edge is installed at eave and rake edges.					
6 P R		These practices are not mandatory for existing building elements without apparent moisture problem.					
6 P RF	11.602.1.10	11.602.1.10 Exterior doors. Entries at exterior door assemblies, inclusive of side lights (if any), are covered by one of the following methods to protect the building from the effects of precipitation and solar radiation. Either a storm door or a projection factor of 0.375 minimum is provided. Eastern- and western-facing entries in Climate Zones 1, 2, and 3, as determined in accordance with Figure 6(1) or Appendix A, have either a storm door or a projection factor of 1.0 minimum, unless protected from direct solar radiation by other means (e.g., screen wall, vegetation).					3+ exterior door
6 P RF		This Project's Climate Zone: 4		2 per exterior door 6 Max	6	6	
6 P RF	(a)	installing a porch roof or awning					
6 P RF	(b)	extending the roof overhang					
6 P RF	(c)	recessing the exterior door					
6 P RF	(d)	Installing a storm door					
6 P RF		Note: The pedestrian door protected in a garage leading to living space does not qualify for points.					
6 P RF	11.602.1.11	11.602.1.11 Tile backing materials. Tile backing materials installed under tiled surfaces in wet areas are in accordance with ASTM C1178, C1278, C1288, or C1325.		Mandatory			Met
6 P RF		This practice is not mandatory for existing tile surfaces without apparent moisture problem.					

6 P R	11.602.1.13	11.602.1.13 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier is installed in accordance with the ICC IRC or IBC at roof eaves of pitched roofs and extends a minimum of 24 inches (610 mm) inside the exterior wall line of the building.	Mandatory			Met
6 P R						
6 P R						
6 P R						
6 P RF	11.602.1.14	11.602.1.14 Architectural features. Architectural features that increase the potential for water intrusion are avoided:				
6 P RF	(1)	All horizontal ledgers are sloped away to provide gravity drainage as appropriate for the application.	Mandatory 1	1	1	Met
6 P RF						
6 P F	11.602.1.15	11.602.1.15 Kitchen and vanity cabinets. All kitchen and vanity cabinets are certified in accordance with the ANSI/KCMA A161.1 performance standard or equivalent.		2	2	2
6 P F		NOTE: Identify what product was used in the assigned Notes area.				<input checked="" type="checkbox"/>
6 P RF	11.602.4	11.602.4 Finished grade.				
6 P RF	11.602.4.1	11.602.4.1 Finished grade at all sides of a building is sloped to provide a minimum of 6 inches (150 mm) of fall within 10 feet (3048 mm) of the edge of the building. Where lot lines, walls, slopes, or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), the final grade is sloped away from the edge of the building at a minimum slope of 2 percent.	Mandatory			Met
6 P RF						
6 P RF						
6 P RF	11.603 REUSED OR SALVAGED MATERIALS					
6 P R	11.603.1	11.603.1 Reuse of existing building. Major elements or components of existing buildings and structures are reused, modified, or deconstructed for later use.				2500 square feet
6 P R						
6 P R		(Points awarded for every 200 square feet (18.5 m ²) of floor area.)	1			
6 P R		NOTE: Describe materials used in the assigned Notes area. Materials, elements, or components awarded points under Section 11.603.1 shall not be awarded points under Section 11.603.2.	12 Max	12	12	
6 P R						
6 P R						
6 P RF	11.604 RECYCLED-CONTENT BUILDING MATERIALS					
6 P RF	11.605 RECYCLED CONSTRUCTION WASTE					
6 P R	11.605.1	11.605.1 Hazardous waste. The construction waste management plan shall include information on the proper handling and disposal of hazardous waste. All hazardous waste is properly handled and disposed of.	Mandatory			<input checked="" type="checkbox"/> TRUE
6 P R						
6 P RF	11.606 RENEWABLE MATERIALS					
6 P RF	11.607 RECYCLING AND WASTE REDUCTION					
6 P RF	11.608 RESOURCE-EFFICIENT MATERIALS					
6 P RF	11.609 REGIONAL MATERIALS					
6 P RF	11.610 LIFE CYCLE ASSESSMENT					
6 P RF	11.611 PRODUCT DECLARATIONS					
6 P RF	11.612 INNOVATIVE PRACTICES					
6 P RF	11.613 RESILIENT CONSTRUCTION					

11.701 MINIMUM ENERGY EFFICIENCY REQUIREMENTS			
7 P R	305.2.5	305.2.5 Energy efficiency. The building shall comply with Section 305.2.5.1 or 305.2.5.2.	Mandatory
7 P R		Please indicate energy modeler's professional credential and, in the notes field, their name. When selecting "Other," enter professional credentials (e.g., engineer, architect) within the notes field.	Mandatory
7 P R			Reduction Path
7 P R			Modeler's Credential:
7 P R			BEMP
7 P RF	11.701.4	11.701.4 Mandatory practices.	
7 P F	11.701.4.0	11.701.4.0 Minimum energy efficiency requirements. Additions, alterations, or renovations to an existing building, building system or portion thereof shall comply with the provisions of the ICC IECC as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with the ICC IECC. An addition complies with the ICC IECC if the addition complies or if the existing building and addition comply with the ICC IECC as a single building.	Mandatory
7 P F			<input checked="" type="checkbox"/>
7 P F			
7 P F			
7 P F			
7 P F			
7 P R	11.701.4.1	11.701.4.1 HVAC systems.	
7 P R	11.701.4.1.1	11.701.4.1.1 HVAC system sizing. Newly installed or modified space heating and cooling system is sized according to heating and cooling loads calculated using ACCA Manual J, or equivalent. New equipment is selected using ACCA Manual S or equivalent.	Mandatory
7 P R			<input checked="" type="checkbox"/> TRUE
7 P R			
7 P R	11.701.4.3	11.701.4.3 Insulation and air sealing.	
7 P R	11.701.4.3.1	11.701.4.3.1 Building Thermal Envelope Air Sealing. The building thermal envelope exposed or created during the remodel is durably sealed to limit infiltration. The sealing methods between dissimilar materials allow for differential expansion and contraction. The following are caulked, gasketed, weather-stripped or otherwise sealed with an air barrier material, suitable film, or solid material:	Mandatory
7 P R			701.4.3.3 Exception:
7 P R			<input type="checkbox"/>
7 P R		(a) All joints, seams and penetrations.	Met
7 P R		(b) Site-built windows, doors, and skylights.	Met
7 P R		(c) Openings between window and door assemblies and their respective jambs and framing.	Met
7 P R		(d) Utility penetrations.	Met
7 P R		(e) Dropped ceilings or chases adjacent to the thermal envelope.	Met
7 P R		(f) Knee walls.	Met
7 P R		(g) Walls, ceilings, and floors separating conditioned spaces from unconditioned space.	Met
7 P R		(h) Behind tubs and showers on exterior walls.	Met
7 P R		(i) Common walls between dwelling units or sleeping units.	Met
7 P R		(j) Attic access openings.	Met
7 P R		(k) Joints of framing members at rim joists.	Met
7 P R		(l) Top and bottom plates.	Met
7 P R		(m) Other sources of infiltration.	Met
7 P R	11.701.4.3.3	11.701.4.3.3 Multifamily air leakage alternative. Multifamily buildings four or more stories in height and in compliance with IECC section C402.5 (Air leakage-thermal envelope) are deemed to comply with Sections 11.701.4.3.1 and 11.701.4.3.2.	<input checked="" type="checkbox"/> e 11.703.4.3.1
7 P R			
7 P R			
7 P R	11.701.4.3.4	11.701.4.3.4 Fenestration air leakage. Newly installed Windows, skylights and sliding glass doors have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m ²), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m ²), when tested in accordance with NFRC 400 or AAMA/WDMA/CSA 101/1.S.2/A440 by an accredited, independent laboratory and listed and labeled. For site-built fenestration, a test report by an accredited, independent laboratory verifying compliance with the applicable infiltration rate shall be submitted to demonstrate compliance with this practice. This practice does not apply to field-fabricated fenestration products.	Mandatory
7 P R		Exception: For Tropical Zones only, jalousie windows are permitted to be used as a conditioned space boundary and shall have an air infiltration rate of not more than 1.3 cfm per square foot.	
7 P R			Met
7 P R	11.701.4.3.5	11.701.4.3.5 Lighting and building thermal envelope. Newly installed luminaires installed in the building thermal envelope which penetrate the air barrier are sealed to limit air leakage between conditioned and unconditioned spaces. All luminaires are IC-rated and labeled as meeting ASTM E283 when tested at 1.57 psf (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All luminaires installed in the building thermal envelope which penetrate the air barrier are sealed with a gasket or caulk between the housing and the interior of the wall or ceiling covering.	Mandatory
7 P R			Met
7 P R			
7 P R			
7 P R			
7 P R			
7 P RF	11.701.4.4	11.701.4.4 High-efficacy lighting. A minimum of 90 percent of newly installed hard-wired lighting fixtures or the bulbs in those fixtures shall be high efficacy.	Mandatory
7 P RF			<input checked="" type="checkbox"/>
7 P R	11.701.4.5	11.701.4.5 Boiler piping. Boiler piping in unconditioned space supplying and returning heated water or steam that is accessible during the remodel is insulated. Exception: where condensing boilers are installed, insulation is not required for return piping.	Mandatory
7 P R			<input checked="" type="checkbox"/> TRUE
7 P R			
7 P R	11.701.4.6	11.701.4.6 Fenestration specifications. The NFRC-certified U-factor and SHGC of newly installed windows, exterior doors, skylights, and tubular daylighting devices (TDDs) do not exceed the values in Table 11.703.2.5.1.	Mandatory
7 P R			Met
7 P R			
7 P R		See Table 11.703.2.5.1	
7 P R	11.701.4.7	11.701.4.7 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the NFRC-certified U-factor and SHGC of the replacement fenestration unit do not exceed the values in Table 11.703.2.5.1.	Mandatory
7 P R			Met
7 P R			
7 P R			

11.901 POLLUTANT SOURCE CONTROL							
9 P RF	11.901.1	11.901.1 Space and water heating options					
9 P R	11.901.1.4	11.901.1.4 Newly installed gas-fired fireplaces and direct heating equipment is listed and is installed in accordance with the NFPA 54, ICC IFGC, or the applicable local gas appliance installation code. Gas-fired fireplaces within dwelling units or sleeping units and direct heating equipment are vented to the outdoors. Alcohol burning devices and kerosene heaters are vented to the outdoors.	Mandatory				N/A
9 P RF	11.901.2	11.901.2 Solid fuel-burning appliances					
9 P RF	11.901.2.2	11.901.2.2 Fireplaces, woodstoves, pellet stoves, or masonry heaters are not installed.	6	6	6		<input checked="" type="checkbox"/>
9 P RF	11.901.3	11.901.3 Garages. Garages are in accordance with the following:					
9 P RF	(2)	A carport is installed, the garage is detached from the building, or no garage is installed.	10	10	10		<input checked="" type="checkbox"/>
9 P RF	11.901.4	11.901.4 Wood materials. A minimum of 85 percent of newly installed material within a product group (i.e., wood structural panels, countertops, composite trim/doors, custom woodwork, and/or component closet shelving) is manufactured in accordance with the following:	10 Max	8	8		
9 P R	(1)	Structural plywood used for floor, wall, and/or roof sheathing is compliant with DOC PS 1 and/or DOC PS 2. OSB used for floor, wall, and/or roof sheathing is compliant with DOC PS 2. The panels are made with moisture-resistant adhesives. The trademark indicates these adhesives as follows: Exposure 1 or Exterior for plywood, and Exposure 1 for OSB.	Mandatory				Met
9 P R		NOTE: If "N/A" is selected, please explain in the Notes area.					
9 P RF		Countertops					(6)
9 P RF		Composite trim/doors					(6)
9 P RF		Custom woodwork					
9 P RF		Component closet shelving					
9 P RF	(2)	Particleboard and MDF (medium density fiberboard) is manufactured and labeled in accordance with CPA A208.1 and CPA A208.2, respectively.	2				
9 P RF	(3)	Hardwood plywood in accordance with HPVA HP-1.	2				
9 P RF	(4)	Particleboard, MDF, or hardwood plywood is in accordance with CPA 4.	3				
9 P RF	(5)	Composite wood or agrifiber panel products contain no added urea-formaldehyde or are in accordance with the CARB Composite Wood Air Toxic Contaminant Measure Standard.	4				
9 P RF	(6)	Non-emitting products.	4				
9 P F	11.901.5	11.901.5 Cabinets. A minimum of 85 percent of newly installed cabinets are in accordance with one or both of the following:					
9 P F		(Where both of the following practices are used, only 3 points are awarded.)					
9 P F	(2)	The composite wood used in wood cabinets is in accordance with CARB Composite Wood Air Toxic Contaminant Measure Standard or equivalent as certified by a third-party program such as, but not limited to, those in Appendix B.	3	3	3		<input checked="" type="checkbox"/>
9 P F	11.901.6	11.901.6 Carpets. Wall-to-wall carpeting is not installed adjacent to water closets and bathing fixtures.	Mandatory				<input checked="" type="checkbox"/>
9 P F	11.901.9	11.901.9 Interior architectural coatings. A minimum of 85 percent of newly applied interior architectural coatings are in accordance with either Section 11.901.9.1 or Section 11.901.9.3, not both. A minimum of 85 percent of architectural colorants are in accordance with Section 11.901.9.2.					
9 P F	11.901.9.1	11.901.9.1 Site-applied interior architectural coatings, which are inside the water proofing envelope, are in accordance with one or more of the following:	5	5	5		
9 P F	(1)	Zero VOC as determined by EPA Method 24 (VOC content is below the detection limit for the method)					<input type="checkbox"/>
9 P F	(2)	GreenSeal GS-11					<input type="checkbox"/>
9 P F	(3)	CARB Suggested Control Measure for Architectural Coatings (see Table 11.901.9.1). See Table 11.901.9.1					<input checked="" type="checkbox"/>
9 P F	11.901.9.4	11.901.9.4 When the building is occupied during the remodel, a minimum of 85 percent of the newly applied interior architectural coatings are in accordance with either 11.901.9.1 or 11.901.9.3.	Mandatory				Met
9 P F	11.901.13	11.901.13 Carbon monoxide (CO) alarms. A carbon monoxide (CO) alarm is provided in accordance with the IRC Section R315.	Mandatory				Met
9 P F	11.901.15	11.901.15 Non-smoking areas. Environmental tobacco smoke is minimized by one or more of the following:					
9 P F	(1)	All interior common areas of a multifamily building are designated as non-smoking areas with posted signage.	1	1	1		<input checked="" type="checkbox"/>
9 P F	(2)	Exterior smoking areas of a multifamily building are designated with posted signage and located a minimum of 25 feet from entries, outdoor air intakes, and operable windows.	1	1	1		<input checked="" type="checkbox"/>
9 P F	11.901.16	11.901.16 Lead-safe work practices. For buildings constructed before 1978, lead-safe work practices are used during the remodeling.	Mandatory				<input checked="" type="checkbox"/>
9 P RF	11.902 POLLUTANT CONTROL						
9 P F	11.902.1	11.902.1 Spot ventilation.					
9 P F	11.902.1.1	11.902.1.1 Spot ventilation is in accordance with the following:					
9 P F	(1)	Bathrooms are vented to the outdoors. The minimum ventilation rate is 50 cfm (23.6 L/s) for intermittent operation or 20 cfm (9.4 L/s) for continuous operation in bathrooms.	Mandatory				TRUE
9 P F	(2)	Clothes dryers (except listed and labeled condensing ductless dryers) are vented to the outdoors.	Mandatory				Met
9 P F	11.902.1.2	11.902.1.2 Bathroom and/or laundry exhaust fan is provided with an automatic timer and/or humidistat:	11 Max	5	5		# of timers: 1 timer(s)
9 P F	(1)	for first device	5				# of humidistats:
9 P F	(2)	for each additional device	2				

9 P F	11.902.2	11.902.2 Building ventilation systems.					
9 P RF	11.902.3	11.902.3 Radon reduction measures. Radon reduction measures are in accordance with IRC Appendix F or § 11.902.3.1. Radon Zones as identified by the AHJ or, if the zone is not identified by the AHJ, as defined in Figure 9(1). This practice is not mandatory if the existing building has been tested for radon and is in accordance with federal and local acceptable limits.	Mandatory			ICC IRC F	
9 P RF							
9 P RF							
9 P RF							
9 P R	11.902.6	11.902.6 Living space contaminants. The living space is sealed in accordance with Section 11.701.4.3.1 to prevent unwanted contaminants.	Mandatory			<input checked="" type="checkbox"/>	TRUE
9 P R							
9 P RF	11.903 MOISTURE MANAGEMENT: VAPOR, RAINWATER, PLUMBING, HVAC						
9 P R	11.903.1	11.903.1 Plumbing. Plumbing is in accordance with one of the following.		5	5		(2)
9 P R	(1)	Cold water pipes in unconditioned spaces are insulated to a minimum of R-4 with pipe insulation or other covering that adequately prevents condensation.		2			
9 P R							
9 P R	(2)	Plumbing is not installed in unconditioned spaces.		5			
9 P RF	11.904 INDOOR AIR QUALITY						
9 P R	11.904.3	11.904.3 Microbial growth & moisture inspection and remediation. A visual inspection is performed to confirm the following:					
9 P R							
9 P R	(1)	Verify that no visible signs of discoloration and microbial growth on ceilings, walls or floors, or other building assemblies Or If minor microbial growth is observed (less than within a total area of 25 square feet) in homes or multifamily buildings, reference EPA Document 402-K-02-003 (A Brief Guide to Mold, Moisture, and Your Home) for guidance on how to properly remediate the issue. If microbial growth is observed, on a larger scale in homes or multifamily buildings (greater than 25 sq ft), reference EPA document 402-k-01-001 (Mold Remediation in Schools and Commercial Buildings) for guidance on how to properly remediate the issue.	Mandatory			<input checked="" type="checkbox"/>	TRUE
9 P R							
9 P R	(2)	Verify that there are no visible signs of water damage or pooling. If signs of water damage or pooling are observed, verify that the source of the leak has been repaired, and that damaged materials are either properly dried or replaced as needed.	Mandatory			<input checked="" type="checkbox"/>	TRUE
9 P R							
9 P RF	11.905 INNOVATIVE PRACTICES						
10 P RF	11.1001 HOMEOWNER'S MANUAL AND TRAINING GUIDELINES FOR ONE- AND TWO-FAMILY DWELLINGS						
10 P RF	11.1002 CONSTRUCTION, OPERATION, AND MAINTENANCE MANUALS AND TRAINING FOR MULTI-UNIT BUILDINGS						
10 P F	11.1002.1	11.1002.1 Building construction manual. A building construction manual, including five or more of the following, is compiled and distributed in accordance with Section 11.1002.0.		1	1		1
10 P F							
10 P F		(Points awarded per two items. Points awarded for non-mandatory items.)					
10 P F	(1)	A narrative detailing the importance of constructing a green building, including a list of green building attributes included in the building. This narrative is included in all responsible parties' manuals.	Mandatory			<input checked="" type="checkbox"/>	
10 P F							
10 P F	(2)	A local green building program certificate as well as a copy of the <i>National Green Building Standard™</i> , as adopted by the Adopting Entity, and the individual measures achieved by the building.	Mandatory			<input checked="" type="checkbox"/>	
10 P F							
10 P F	(3)	Warranty, operation, and maintenance instructions for all equipment, fixtures, appliances, and finishes.	Mandatory			<input checked="" type="checkbox"/>	
10 P F							
10 P F	(4)	Record drawings of the building.				<input checked="" type="checkbox"/>	
10 P F							
10 P F	(5)	A record drawing of the site including stormwater management plans, utility lines, landscaping with common name and genus/species of plantings.				<input checked="" type="checkbox"/>	
10 P F							
10 P F	(6)	A diagram showing the location of safety valves and controls for major building systems.				<input type="checkbox"/>	
10 P F							
10 P F	(7)	A list of the type and wattage of light bulbs installed in light fixtures.				<input type="checkbox"/>	
10 P F							
10 P F	(8)	A photo record of framing with utilities installed. Photos are taken prior to installing insulation and clearly labeled.				<input type="checkbox"/>	
10 P F							
10 P F	11.1002.2	11.1002.2 Operations manual. Operations manuals are created and distributed to the responsible parties in accordance with Section 11.1002.0. Between all of the operation manuals, five or more of the following options are included.		1	2		2
10 P F							
10 P F		(Points awarded per two items. Points awarded for non-mandatory items.)					
10 P F	(1)	A narrative detailing the importance of operating and living in a green building. This narrative is included in all responsible parties' manuals.	Mandatory			<input checked="" type="checkbox"/>	
10 P F							
10 P F	(2)	A list of practices to conserve water and energy (e.g., turning off lights when not in use, switching the rotation of ceiling fans in changing seasons, purchasing ENERGY STAR appliances and electronics).	Mandatory			<input checked="" type="checkbox"/>	
10 P F							
10 P F	(3)	Information on methods of maintaining the building's relative humidity in the range of 30 percent to 60 percent.				<input checked="" type="checkbox"/>	
10 P F							
10 P F	(4)	Information on opportunities to purchase renewable energy from local utilities or national green power providers and information on utility and tax incentives for the installation of on-site renewable energy systems.				<input type="checkbox"/>	
10 P F							
10 P F	(5)	Information on local and on-site recycling and hazardous waste disposal programs and, if applicable, building recycling and hazardous waste handling and disposal procedures.				<input checked="" type="checkbox"/>	
10 P F							
10 P F	(6)	Local public transportation options.				<input checked="" type="checkbox"/>	
10 P F							
10 P F	(7)	Explanation of the benefits of using compact fluorescent light bulbs, LEDs, or other high-efficiency lighting.				<input type="checkbox"/>	
10 P F							
10 P F	(8)	Information on native landscape materials and/or those that have low water requirements.				<input type="checkbox"/>	
10 P F							
10 P F	(9)	Information on the radon mitigation system, where applicable.				<input type="checkbox"/>	
10 P F							
10 P F	(10)	A procedure for educating tenants in rental properties on the proper use, benefits, and maintenance of green building systems including a maintenance staff notification process for improperly functioning equipment.				<input type="checkbox"/>	
10 P F							
10 P F	(11)	Information on the importance and operation of the building's fresh air ventilation system.	Mandatory per 902.2.1			<input checked="" type="checkbox"/>	
10 P F							

SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Selective demolition of building elements for alteration purposes.
- D. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

- A. Section 00 31 00 - Available Project Information: Existing building survey conducted by Owner; information about known hazardous materials.
- B. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- C. Section 01 10 00 - Summary: Sequencing and staging requirements.
- D. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- E. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- F. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- G. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- H. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- I. Section 02 65 00 - Underground Storage Tank Removal.
- J. Section 07 01 50.19 - Preparation for Re-Roofing: Removal of existing roofing, roof insulation, flashing, trim, and accessories.
- K. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal.
- L. Section 31 22 00 - Grading: Topsoil removal.
- M. Section 31 22 00 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- N. Section 31 23 23 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.
- O. Section 32 93 00 - Plants: Relocation of existing trees, shrubs, and other plants.
- P. Section 32 93 00 - Plants: Pruning of existing trees to remain.

1.3 REFERENCE STANDARDS

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.4 SUBMITTALS

- A. Refer to Section 01 40 00 - Quality Requirements for Submittal procedures.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.

- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.5 WARRANTY

- A. Provide subcontractor warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Fill Material: As specified in Section 31 23 23 - Fill.

PART 3 EXECUTION

3.1 SCOPE

- A. Remove portions of existing buildings in the following sequence:
- B. Remove paving and curbs as required to accomplish new work.
- C. Remove all other paving and curbs within site boundaries.
- D. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.
- E. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.
- F. Remove concrete slabs on grade within site boundaries.
- G. Remove underground tanks.
- H. Remove fences and gates.
- I. Remove creosote-treated wood utility poles.
- J. Remove other items indicated, for salvage, relocation, recycling, and_____.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Use of explosives is not permitted.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 4. Provide, erect, and maintain temporary barriers and security devices.
 - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permit.
 - 8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.

- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.
- F. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Comply with requirements of Section 01 74 19 - Waste Management.
 - 2. Dismantle existing construction and separate materials.
 - 3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- G. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.
- H. Underground Storage Tanks: Remove and dispose of as specified in Section 02 65 00.

3.3 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and _____): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. See Section 01 10 00 for other limitations on outages and required notifications.

4. Verify that abandoned services serve only abandoned facilities before removal.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch as specified for patching new work.

3.5 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 02 82 13 - ASBESTOS ABATEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Isolation of work site to create a regulated area.
- B. Complete preparation of work area.
- C. Removal of non-salvageable non-contaminated materials as shown on Drawings and specified herein.
- D. Removal and disposal of all asbestos-containing materials as quantified in Exhibit 1 Appendix A and specified herein.
- E. Prior to commencement of work at the site; Contractor is responsible for identifying all materials, finishes, and equipment not in good condition.

1.2 RELATED SECTIONS

- A. Section 02 83 33.13 - Lead Paint Abatement.
- B. Work performed by other contractors.
- C. Restoration work.

1.3 REFERENCES

- A. American National Standards Institute
 - 1. SS-EN 1822-1 - High efficiency air filters (HEPA and ULPA), Part 1: Classification, performance testing, marking.
- B. Code of Federal Regulation
 - 1. 29 CFR 1926.1101 - Asbestos.
 - 2. 40 CFR 61.145 - National Emission Standards for Hazardous Air Pollutants (NESHAP), National Emission Standard for Asbestos, Standard for Demolition and Renovation.
 - 3. 40 CFR 161.150 - National Emission Standards for Hazardous Air Pollutants (NESHAP), National Emission Standard for Asbestos, Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation, and Spraying Operations.
 - 4. 40 CFR 763 - Asbestos (rules implementing Asbestos Hazard Emergency Response Act).
 - 5. 42 CFR 84 - Approval of Respiratory Protective Devices.
- C. National Fire Protection Association
 - 1. NFPA 70 - National Electrical Code.
- D. National Institute for Occupational Safety and Health
 - 1. Certified Equipment List.

1.4 REGULATIONS

- A. All work must conform to latest rules and regulations of the Environmental Protection Agency (EPA), National Emission Standards for Hazardous Air Pollutants (NESHAPS), the OSHA regulations on asbestos, 29 CFR 1926.1101, as applicable and federal, state and local government laws, rules and regulations which are incorporated by reference.
- B. The work must conform to requirements specified herein and in Exhibit 1, both of which are a part of these Contract Documents.
- C. Wherever inconsistencies occur between referenced materials, the more stringent shall apply. Intent of these documents is to assure that the work is conducted in a manner that provides highest level of safety.

1.5 TESTING SERVICES

- A. Contractor remains fully responsible for health and safety of all persons coming into contact with affected areas.
- B. Contractor is responsible, at a minimum, for all Personal Samples required in accordance with OSHA regulations on Asbestos, 29 CFR 1926.1101, as applicable, without limitation of Contractor's responsibility to comply with all applicable laws, rules and regulations.

- C. PER TESTING STANDARDS SCOPE Abatement oversight will be for recognized asbestos containing material as defined by the abatement specifications.
- D. Owner will be responsible for all other sampling.
- E. Contractor is responsible for obtaining test results from Owner. A procedure will be agreed upon at a meeting held after award and prior to commencement of work at the site.
- F. Turnaround time for air samples collected during abatement shall be morning of second working day nom day on which they were taken (e.g. samples taken on Monday will be reported to Contractor on Wednesday morning).

1.6 QUALITY ASSURANCE

- A. The Work consists of removal and disposal of asbestos-containing materials. Asbestos is proven to be a material which can cause a serious health risk to humans. The Work is governed by a body of local, state and federal rules, regulations and laws. Contractor agrees by accepting the Contract that he is fully knowledgeable of this information and will bear full responsibility for health and safety of his staff and all people, including Owner's employees and invitees, and all third party persons who come in contact with the work site. Contractor must state in writing any concerns he has about adequacy of rules, regulations and laws or the Contract Documents. Letter must be specific and include alternative safeguards and procedures that will correct stated inadequacies.
- B. Contractor remains responsible for health and safety of workers and for all personal samples required. Owner will have Engineer monitoring the work and collecting area air samples for Owner to further assure conformance to the Contract Documents.
- C. Contractor shall cooperate with Owner/GC/Engineer and the inspection for abatement oversight. This cooperation shall include allowing access to the Work to allow for visual monitoring, collecting area air samples for Owner, providing requested data on personnel, equipment, scheduling and any other matter which facilitates Owner's monitoring of the Work.
- D. Contractor shall not allow anyone access to site who is not authorized by Owner to enter site of the Work.
- E. Contractor shall provide all authorized persons full protective clothing, one Powered Air Purifying Respirator (PAPR) with adequate filters and/or one type "C" respirator for usage without charge. Contractor shall allow full use of all facilities by Owner's consulting Engineer.
- F. Contractor is responsible for maintaining a log of all personnel who enter work area. A copy of all logs shall be submitted to Owner/GC on a weekly basis.
- G. Under no circumstances will equipment placed by the abatement oversight monitoring be moved. adjusted or otherwise adjusted by anyone other than the monitoring contractor.

1.7 SUBMITTALS

- A. Refer to Section 01 40 00 - Quality Requirements for Submittal procedures.
- B. Contractor shall follow procedures set forth in NESHAPS, 40 CFR 61.145, OSHA, 29 CFR 1926.1101, EPA, 40 CFR 763, and all other laws, rules and regulations as applicable.
- C. Contractor shall submit a detailed proposed work schedule and staffing report at pre-abatement meeting with Owner. Included shall be, at a minimum (but without limitation of Contractor's responsibility to comply with all applicable laws, rules and regulations):
 1. Floor plan showing each work area, location of containment partitions, locations of decontamination and equipment units, location of termination of HEPA filtered exhaust ducts, and paths of exit travel and egress routes in emergencies.
 2. Proposed staffing by day and type.
 3. Calendar bar chart which shows activities such as set-up of containment barriers, removal operations, clean-up operations, removal of containment barriers, and completion of all Work.
- D. Manufacturer's data on all materials used at work place shall be submitted by Contractor at least two weeks prior to commencement of Work.

- E. Contractor shall submit the following pre-abatement information to Owner/GC at or prior to pre-abatement meeting:
1. Insurance Certificates
 - a. Asbestos specific
 - b. Lead specific
 - c. General liability
 - d. Workers compensation
 - e. Automobile
 - f. Aggregate/umbrella
 - g. Owner and Engineer to be named as additional insureds.
 2. Notification/Permits
 - a. United states Environmental Protection Agency
 - b. State, county, local agencies (Department of Natural Resources, local building department, local fire and police departments, etc.)
 - c. Permits for transportation to and disposal at approved landfill.
 3. Site (in Addition to 1.07.B.1.)
 - a. Decontamination unit location
 - b. Waste-out location
 - c. HEPA filtered exhaust duct locations
 - d. Owner occupancy
 - e. Utility Requirements
 - 1) Water
 - 2) Electrical
 - 3) Power
 - 4) Telephone
 - f. Storage areas, staging areas, etc.
 - g. Parking
 - h. Building security, entrance-exit
 - i. Work schedule - 1st shift, etc.
 - j. Discharge of filtered waste water
 - k. List of workers to be on-site, titles, experience
 4. Submittals
 - a. Name and location of disposal site.
 - b. Copy of landfill handling procedures, signed by the landfill owner.
 - c. Documentation of worker licenses.
 - d. Copies of physicals.
 - e. Drawings of decontamination chambers and barriers.
 - f. NIOSH approvals for respirators.
 - g. Manufacturer's certification of HEPA filters for respirators.
 - h. Manufacturer's certification of HEPA filter capabilities for HEPA vacuums, HEPA filtered exhaust units, etc.
 - i. Manufacturer's certification that equipment conforms to ANSI SS-EN 1822-1
 - j. Documentation that all employees and agents are fit tested.
 - k. Notification to rental companies for use of equipment on abatement site.
 - l. Materials.
 - 1) Encapsulant characteristics.
 - 2) Encapsulant compatible with replacement materials.
 - 3) Glove bag.
 - m. Schedule of values.
 - n. Work area.
 - o. Electrical, mechanical; coordinate with Owner's personnel for installation.
 - p. Shop Drawings.
 5. Arrangement for meetings
 - a. Daily

- b. Weekly
- 6. Emergency Phone Numbers
 - a. Engineer
 - b. Contractor
 - c. Building Owner
- F. Owner will not issue written permission for Contractor to commence abatement until all requirements above have been met. Failure to obtain Owner's written permission shall not relieve Contractor of requirement to meet Time of Completion as outline in Agreement.

1.8 PROJECT SITE CONDITIONS

- A. Contractor is responsible for having made a detailed review of work place prior to his having submitted a proposal. Contractor is expected to have considered, and included in his bid, all aspects of existing conditions and their impact, particularly to cost and health and safety, to his work.
- B. Owner will make arrangements to allow access to site. Hours that Contractor will work may be restricted as follows:
 - 1. To be Determined by Owner.
- C. The Work shall be limited to specific areas of building and site. Unlimited access is specifically not permitted. Arrangements for use of building and site will be restricted to those areas specifically allowed by Owner.
- D. Contractor shall verify shut down, lockout, tag out of mechanical and electrical systems in containment. HEPA filtered exhaust units shall operate continuously 24 hours per day and exhaust to exterior of building, where feasible.
- E. Owner shall approve of location of temporary on-site ACM waste storage.

1.9 PROJECT COORDINATION

- A. Engineer shall have authority and responsibilities defined by Owner in accordance with federal, state and local laws and regulations and in accordance with the Agreement.
- B. Contractor's General Superintendent shall have been trained in accordance with 40 CFR Part 763, Model Contractor Accreditation Plan. This person shall meet requirement of a Competent Person as defined by OSHA, 29 CFR 1926.1101.
- C. Contractor's General Superintendent shall also meet requirements of NESHAPS 61.145 section C(8) for on-site representative and shall be present during removal operations.
- D. Project construction meetings will be held weekly.

1.10 EMERGENCY EVACUATION

- A. Contractor shall prepare a contingency plan for emergencies (including decontamination or work area isolation procedures) and shall review and designate emergency exits in adequate number and location to safely exit population in the event of need to do so. Consideration shall be given to resultant contamination, but as a second priority to life safety. Contractor is responsible for all required decontamination or work area isolation.

1.11 WARRANTY

- A. Provide subcontractor warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

- A. All materials shall be in accordance with all applicable laws, rules and regulation and in new and from unopened containers.
- B. Materials shall be stored in areas designated by Owner.

- C. All plastic sheeting shall be minimum 6 mil.
- D. All circuits providing power to containment area will be equipped with Ground Fault Interrupter (GFI) devices at source of power.

PART 3 EXECUTION

3.1 PERSONNEL PROTECTION

- A. Contractor is required to provide all training and equipment for its staff and workers and to provide 1/2 Face, Powered Air Purifying Respirator (PAPR) and/or Type "C" respiratory protection equipment for his staff and workers and otherwise protect all persons in accordance with all applicable laws, rules and regulations.
- B. Contractor is responsible for preventing unauthorized personnel from entering work area.
- C. Authorized persons not employed or paid by Contractor must show evidence of proper respirator training and have a fitted PAPR.
- D. Personnel protection shall consist of full body and head covering as well as 1/2 Face, PAPR or Type "C" respirator (pressure demand mode air flow) depending on Project status.
- E. In areas where VAT mastic is removed with chemical solvents, Contractor shall provide and use 1/2 Face or PAPR respiratory protection with dual cartridge organic vapor HEPA filters or Type "C".

3.2 BUILDING PROTECTION

- A. Contractor shall follow Owner's recommendations to protect building, and take any and all other reasonable and necessary precautions to protect building, subject to Owner's approval, provided, however, that, in any event, Contractor shall follow all applicable laws, rules and regulations in protecting building.
- B. Contaminated filters in HEPA filtered exhaust units shall be removed only in contained or regulated areas, and disposed of as ACM waste.

3.3 STOP WORK ORDER

- A. Owner, Owner's Representative, and Engineer has authority to stop asbestos removal at any time activities or abatement conditions are not within specification requirements. Work will not resume until conditions have been corrected. Following are examples of situations requiring a stop work order:
 - 1. Excessive airborne fibers outside containment area.
 - 2. Break in containment barriers.
 - 3. Loss of pressure differential (at or above -0.02 inches of water).
 - 4. Serious injury within containment area.
 - 5. Fire alarm system failure.
 - 6. Respiratory protection system failure.
 - 7. Power failure.
 - 8. Excessive airborne fibers inside containment area.
- B. Work stoppage will continue until unacceptable conditions have been corrected. Written authorization from Owner, Owner's Representative, or Engineer is required prior to commencing removal operations.
- C. Standby time, delays, and costs incurred for corrective action is at Contractor's expense.

3.4 WORK AREA PROTECTION

- A. Compliance orders from Maricopa County Air Quality Control will be managed and maintained by the Abatement Oversight/Air Monitoring contractor.
- B. Contractor shall prepare the work area as follows:
 - 1. Establish a regulated area and post caution signs in accordance with 29 CFR 1926.1101 and 40 CFR 763.
 - 2. Verify shut down and lock out of electric power to all work areas. Provide temporary power and lighting and ensure safe installation of temporary power sources and equipment in

accordance with National Electrical Code. All power to work areas shall be brought in from outside the area through a ground-fault interrupter (GFI) at source.

3. Verify shut down and isolation of heating, cooling, and ventilating air systems.
 4. Pre-clean work area and any fixed objects within work area using wet methods and/or HEPA vacuums. Cleaned fixed objects shall be wrapped with 6-mil plastic sheeting and sealed with tape.
 5. Construct isolation containment barriers as described below.
 6. Maintain emergency and fire exits from work areas.
- C. Owner will provide Contractor with required information on shutting off all ventilation equipment to affected areas.
- D. Isolation Containment Barriers:
1. Critical Barriers:
 - a. Contractor shall physically isolate work area from other portions of building. Small openings such as cracks at doors and windows shall be sealed with plastic sheeting which is then sealed at its perimeter with duct tape. In some instances, critical barrier may be an entire temporary wall fabricated from plastic sheeting or other materials.
 2. Primary Barriers (Gross Removal Areas):
 - a. Horizontal and vertical surfaces shall be pre-cleaned and sealed by Contractor with two (2) layers of 6-mil plastic sheeting unless noted otherwise. Primary barriers are to be installed by Contractor over critical barriers. Plastic sheeting will be cleaned and disposed of by Contractor as ACM waste upon completion of removal activities.
- E. All furniture, window blinds, draperies, and other furnishings are considered as incidental to the abatement process.
- F. All HEPA filtered exhaust unit ductwork shall terminate at exterior of building, where feasible.

3.5 EQUIPMENT AND WASTE CONTAINER REMOVAL DECONTAMINATION SYSTEM

- A. Decontamination unit shall consist of three (3) chambers including a waste load out area and two (2) airlocks, each to be a minimum of three (3) feet long with three (3) overlapping sheets of plastic at each opening.
- B. Seal vertical and horizontal openings similar to vertical and horizontal surfaces described under WORK AREA PREPARATION.

3.6 WORKER DECONTAMINATION SYSTEM

- A. Decontamination unit shall consist of five (5) chambers including an equipment room, shower, and clean room separated by airlocks. Chambers shall be separated by three (3) overlapping sheets of plastic.
- B. Location(s) of decontamination unit(s) will be designated by Contractor.
- C. Cover vertical (one layer of 6 mil) and horizontal (one layer of 4 mil) surfaces with two (2) layers of 6-mil plastic sheeting on walls and three (3) layers of 6-mil plastic sheeting on floors. Where thermal insulation is abated in bulk, wet methods under negative pressure.
- D. Hot and cold water, soap and disposable towels must be provided to decontamination unit.
- E. Decontamination unit must be a minimum of seven feet (7'-0") tall, inside height.
- F. Decontamination unit shall be water-tight. Contractor will be liable and responsible to Owner for any leaks/damages occurring during abatement.

3.7 MAINTENANCE OF DECONTAMINATION ENCLOSURE SYSTEM AND WORKPLACE BARRIERS

- A. Contractor shall perform the following:
 1. All containment barriers shall be inspected by Contractor's Competent Person at least twice daily. Inspections and observations shall be documented in daily project log. Damage and defects in enclosure system shall be repaired upon discovery.

2. Smoke tubes shall be used to test effectiveness of work area barrier system before abatement work begins. Results and observations shall be documented in project log book.
 3. At any time during abatement activities after barriers have been erected, if visible emissions are observed outside of work area or if damage occurs to barriers, work shall stop, repairs shall be made to barriers, and visible residue cleaned up using appropriate HEPA vacuuming and wet wiping procedures prior to resuming abatement activities.
 4. Contractor shall HEPA vacuum or wet wipe equipment decontamination enclosure system and entire worker decontamination enclosure system as necessary and at end of each day of abatement activities.
 5. HEPA filtered exhaust units shall be ventilated to outside of building away from occupied areas. Careful installation and daily inspections shall be done to insure that ductwork does not release fibers into uncontaminated building areas.
 6. Once constructed and reinforced, and with HEPA filtered exhaust units in operation, worker and equipment decontamination enclosures shall be tested for leakage utilizing smoke tubes. Enclosures shall be repaired or reconstructed as needed.
- B. Contractor shall provide copies of Project log to the Owner/GC on a weekly basis.
 - C. The Owner/GC shall be immediately notified of any problem that has developed such as puncture of barrier system, electrical power loss, GFI failure, equipment failure, accidental discharge into occupied areas, partial collapse of protection system (plastic sheet fails to remain in proper place), etc.
 - D. Contractor shall be responsible for monitoring pressure differential for all gross containment areas. Contractor shall use a magnehelic gauge with a strip chart recorder for a 24 hour (constant) pressure differential recording. REPA filtered exhaust units shall be installed and operated to provide a minimum of one air change in work area every 15 minutes. A pressure differential of at least -0.02 inches of water shall be established. One (1) back-up HEPA filtered exhaust unit shall be installed in case of equipment failure.

3.8 COMMENCEMENT OF WORK

- A. Abatement shall not begin until the following have occurred:
 1. Enclosures have been constructed and smoke tested.
 2. Contractor submittals, notifications, posting, and permits have been provided and are satisfactory to Owner and Engineer.
 3. Equipment for removal, clean up and disposal are on-site.
- B. Notification to start shall be received from Engineer and Owner in written form.

3.9 WORKPLACE ENTRY ANDEXIT

- A. Contractor shall maintain emergency and fire exits from work area or established alternative exits satisfactory to local fire departments.
- B. Contractor shall follow Procedures set forth in OSHA, 29 CFR 1926.1101, EPA, 40 CFR 763, and any other laws, rules and regulations, as applicable. Enforcement is responsibility of Contractor.
- C. Contractor shall maintain an entry log with copies of State Certification, of those persons who enter/exit work area. Copies of entry log shall be submitted to Engineer weekly.
- D. Entry shall be controlled by Contractor to prevent unauthorized, accidental access into work area.
- E. Half Face, P APR's and Type "c" units shall be wet wiped by Contractor prior to re-entry into clean room from work site.

3.10 ENCAPSULATION PROCEDURES

- A. Asbestos is not being encapsulated in lieu of removal.
- B. All surfaces from which ACM has been removed shall be coated by Contractor with an encapsulant appropriate to surface to which it is applied.

- C. Encapsulant shall be applied with use of an airless sprayer.
- D. Encapsulation shall not commence until ACM removal is complete and area passes visual inspection by Engineer.

3.11 CLEARANCE AIR MONITORING AND ANALYSIS

- A. Inspection by Abatement Oversight/Air Monitoring will not include TEM sampling and therefore require no special procedure.
- B. Prior to conducting final clearance testing, an on-site designated Contractor's representative shall certify that final cleaning of asbestos abatement work enclosure (containment) has been completed and shall approve conducting final clearance testing.
- C. Asbestos abatement work area is cleared when work area is visually clean and airborne asbestos structure concentrations have been reduced to level specified below. Work of this Section will not begin until visual inspection is complete and has been certified by Project Administrator.
- D. Air Monitoring to determine if elevated airborne asbestos structure concentration encountered during abatement operations has been reduced to specified level, Owner will secure samples and analyze them according to the following procedures.
 - 1. Aggressive sampling procedures will be followed.
 - 2. TEM samples may be secured and, if so, analyzed as indicated below.

3.12 EQUIPMENT AND WASTE CONTAINER REMOVAL

- A. Contractor shall handle all equipment and waste container removal as described in NESHAPS, 40 CFR 61.150.
- B. Equipment and Waste Containers shall be removed by Contractor from work area according to the following:
 - 1. Equipment and waste containers should be placed into clean up room of equipment decontamination enclosure system, wet wiped, and placed into a second 6-mil plastic bag.
 - 2. Equipment and waste containers should then be placed into holding area.
 - 3. Equipment and waste containers should be removed from holding area by workers who have entered from uncontaminated areas dressed in clean protective clothing and respiratory protection on a daily basis.
 - 4. Exit from equipment decontamination enclosure system shall be secured to prevent unauthorized entry.
- C. Holding area shall be separated from clean, non-contained areas to prevent unauthorized access.
- D. Holding area must be large enough to hold stored material to prevent puncturing containers or bags. Contractor shall remove containers and bags as they accumulate on a daily basis to required covered and locked container that will haul them from site.

3.13 DISPOSAL PROCEDURES

- A. Contractor shall follow procedures set forth in OSHA, 29 CFR 1926.1101, NESHAPS, 40 CFR 61.150, EPA, 40 CFR 763, and any other applicable laws, rules and regulations.
- B. Abatement Oversight Contractor shall have access to a random sample of all material for disposal.
- C. Removed ACM waste shall be adequately wet and double bagged with 6-mil plastic bags or single bagged and placed in approved sealed containers for disposal.
- D. Contractor shall transport ACM waste directly to landfill from work site.
- E. All dump receipts, trip tickets, waste shipment records and other documentation of disposal shall be delivered to Owner within 10 days after ACM waste leaves site.
- F. Waste shipment record shall accompany all ACM waste that is transported off work site. Waste shipment record shall be completed and include necessary information in accordance with NESHAPS, 40 CFR 61.150, and any other applicable laws, rules and regulations.

- G. Waste shipment record shall include the following:
 - 1. Name and address of work site.
 - 2. Name and phone number of Owner.
 - 3. Name and address of company performing abatement.
 - a. Name and phone number of authorized agent.
 - 4. Name, address, physical site location, EPA identification number and phone number of waste disposal site.
 - 5. Name and address of agency responsible for administering asbestos NESHAP program.
 - 6. Type of asbestos waste material generated.
 - a. Amount of friable and non-friable asbestos material.
 - 7. Number and type of containers used.
 - 8. Quantity of asbestos waste.
 - 9. Special handling procedures, instructions.
- H. Generator, transporter, and disposal site operator shall each sign and date waste shipment record when waste is received, respectively. Each shall keep a copy of shipment record with appropriate signatures. Waste disposal site operator shall return a completed copy of shipment record to waste generator.
- I. Labeled containers and wrapped materials shall contain name of waste generator and location at which waste was generated.
- J. If rental trucks are used to transport ACM, Contractor must provide Owner with waiver from rental company stating rental company's approval of use of equipment for ACM hauling.

3.14 RE-ESTABLISHMENT OF WORK AREA

- A. Work area shall be reestablished by Contractor only after area passes visual clearance inspection and/or clearance air monitoring.
- B. Remaining barriers and worker and equipment decontamination units shall be removed and disposed of by Contractor as asbestos-containing waste. Entire area, including HV AC filter assembly and ductwork, shall be wet wiped and/or HEPA vacuumed to remove residual asbestos fibers.
- C. Mounted objects removed from former positions during area preparations activities shall be re-secured by Contractor.
- D. Objects moved to temporary locations shall be relocated by Contractor to original positions.
- E. New filters shall be installed by Contractor in HV AC systems, and mechanical and electrical systems shall be reestablished by Contractor in working order.
- F. All surfaces shall be checked for damage by Contractor and Engineer. All damaged areas shall be restored to their pre-abatement condition.

3.15 SUBSTANTIAL COMPLETION (ASBESTOSWORK)

- A. Substantial Completion is the stage in progress of the project where the Work, or a designated portion thereof, is sufficiently complete in accordance with the Contract Documents so that Owner can safely occupy, begin reconstruction or utilize area for its intended use. At this stage in progress of the Project, Engineer has cleared area with final air sampling, all barriers designated by Engineer have been removed, and all asbestos abatement equipment, material, and waste have been removed.
- B. Work shall be substantially complete with respect to asbestos work by date stated in the Contract. Engineer has been contracted to perform its services during this time frame. All additional costs incurred by Owner or Engineer due to Contractor's failure to complete work within designated time will be compensated by Owner to extent required by Owner/Architect Agreement and deducted from final payment to Contractor.
- C. Final acceptance of abatement will not be considered concluded unless the Abatement oversight and air monitoring reviews are complete.

3.16 CONTRACTOR CERTIFICATION

- A. Upon completion of the Work, Contractor shall certify that the Work was done in strict compliance with all applicable laws, rules and regulations, and the Contract Documents.

3.17 SCHEDULE

- A. The Environmental Phase II Summary Report is available upon request. Complete copies of the report will be provided to all asbestos abatement bidders upon request.

END OF SECTION

**SECTION 05 5213
PIPE AND TUBE RAILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Stair railings and guardrails.

1.02 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2012.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2015.
- C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2012.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2015.
- F. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2012.
- G. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2010.
- H. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications 2013.
- I. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2013.
- J. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Samples: Submit two, 12 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Handrails and Railings:
 - 1. C.R. Laurence Company, Inc; CRL Welded Post Railing Systems (WRS): www.crl-arch.com/#sle.
 - 2. KaneSterling: www.sterlingdula.com/#sle.
 - 3. Superior Aluminum Products: www.superioraluminum.com
 - 4. The Wagner Companies: www.wagnercompanies.com/#sle.
- B. Fall Protection Guardrail :
 - 1. Leading Edge Safety: USM-IBC Guardrail. Color: match metal roof coping.

2.02 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 ALUMINUM MATERIALS

- A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- B. Non-Weld Mechanical Fittings: Slip-on cast aluminum, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- C. Exposed Fasteners: No exposed bolts or screws.

2.04 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

2.05 ALUMINUM FINISHES

- A. Where indicated as Clear Anodized provide Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
- C. Color: To be selected by Architect from manufacturer's standard line.
- D. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

- C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.
- F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

**SECTION 06 1000
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough opening framing for doors, windows, and roof openings.
- B. Sheathing.
- C. Subflooring.
- D. Underlayment.
- E. Roof-mounted curbs.
- F. Roofing nailers.
- G. Preservative treated wood materials.
- H. Fire retardant treated wood materials.
- I. Miscellaneous framing and sheathing.
- J. Communications and electrical room mounting boards.
- K. Concealed wood blocking, nailers, and supports.
- L. Roof sheathing with factory applied roofing underlayment.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 5400 - Cast Gypsum Based Underlayment.
- C. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
- D. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- E. Section 06 0573 - Wood Treatment: Field-applied termiticide and mildicide for wood.
- F. Section 06 1500 - Wood Decking.
- G. Section 06 1753 - Shop-Fabricated Wood Trusses.
- H. Section 07 2500 - WEATHER BARRIERS: Water-resistive barrier over sheathing.
- I. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.
- J. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. APA PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels (Form E445); 2001.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- E. AWPA U1 - Use Category System: User Specification for Treated Wood 2018.
- F. PS 1 - Structural Plywood 2009.
- G. PS 2 - Performance Standard for Wood-Based Structural-Use Panels 2010.
- H. PS 20 - American Softwood Lumber Standard 2020.

- I. SPIB (GR) - Grading Rules 2014.
- J. WWPA G-5 - Western Lumber Grading Rules 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.
- C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.
- D. Samples: For rough carpentry members that will be exposed to view, submit two samples, 24by24 inch in size illustrating wood grain, color, and general appearance.
- E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Stud Framing (2 by 2 through 2 by 6):
 - 1. Species: Any allowed under referenced grading rules and meeting requirements stipulated on the drawings or elsewhere in the project manual.
 - 2. Grade: No. 2.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 EXPOSED DIMENSION LUMBER

- A. Grading Agency: Western Wood Products Association; WWPA G-5.
- B. Sizes: Nominal sizes as indicated on drawings.
- C. Surfacing: S4S.
- D. Moisture Content: S-dry or MC19.

2.04 STRUCTURAL COMPOSITE LUMBER

- A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.
- B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
 - 1. Beams: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published E (modulus of elasticity): 1,800,000 psi, minimum.
 - 2. Manufacturers:
 - a. Weyerhaeuser Company; [____]: www.weyerhaeuser.com/#sle.
 - b. Boise Cascade; [____]: www.bc.com.
 - c. Georgia-Pacific Corp.; [____]: www.buildgp.com.

2.05 CONSTRUCTION PANELS

- A. Subfloor/Underlayment Combination: Any PS 2 type, rated Single Floor.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 24.
 - 3. Performance Category: 3/4 PERF CAT.
 - 4. Thickness: 3/4 inches, nominal.
 - 5. Edges: Tongue and groove.
- B. Subflooring: APA PRP-108: Rated Sheathing.
 - 1. Exposure Class: Exterior.
 - 2. Span Rating: 32/16 inches.
 - 3. Thickness: 3/4 inch, nominal.
- C. Roof Sheathing: APA PRP-108, Rated Sheathing, Exterior Exposure Class, and as follows:
 - 1. Span Rating: 24/0.
 - 2. Thickness: 5/8" nominal.
- D. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
 - 1. Grade: Sheathing.
 - 2. Performance Category: 1/2 PERF CAT.
 - 3. Span Rating: 32/16.
 - 4. Edges: Square with panel clips.
 - 5. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
 - 6. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
 - 7. Manufacturers:
 - a. Huber Engineered Woods, LLC; AdvanTech Sheathing: www.huberwood.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- E. Wall Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
 - 1. Span Rating: 24/0.

- F. Wall Sheathing: Oriented strand board structural wood panel; PS 2.
 - 1. Bond Classification: Exposure 1.
 - 2. Size: 4 feet wide by 8 feet long.
 - 3. Edge Profile: Square edge.
- G. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
- B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
 - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
- D. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls. Provide [] manufactured by [].
- E. Sill Flashing: As specified in Section 07 6200.
- F. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed.
- G. Water-Resistive Barrier: As specified in Section 07 2500.

2.07 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
 - 1. Manufacturers:
 - a. Lonza Group; []: www.wolmanizedwood.com/#sle.
 - b. Hoover Treated Wood Products, Inc; []: www.frtw.com/#sle.
 - c. Koppers, Inc; []: www.koppersperformancechemicals.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Preservative Treatment:
 - 1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - d. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

- A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- B. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except[] where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.
- B. Subflooring: Glue and nail to framing; staples are not permitted.
- C. Space or gap subflooring in accordance with the manufacturer's instructions.
- D. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.

1. At long edges provide solid edge blocking where joints occur between roof framing members.
 2. Nail panels to framing; staples are not permitted.
- E. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails or screws.
1. Provide 1/8" gap minimum between panel ends and edges. Use a spacer tool to assure accurate and consistent spacing.
 2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.
- F. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 3. Install adjacent boards without gaps.
- G. Wall Sheathing and Roof Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs as recommended by manufacturer.
1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
 2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
 3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
 4. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.
- C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.07 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
 1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
 3. Do not burn scraps that have been pressure treated.
 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 2000 FINISH CARPENTRY

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- D. Section 06 4200 - Wood Paneling: Shop fabricated custom paneling.
- E. Section 08 1416 - Flush Wood Doors.
- F. Section 08 1433 - Stile and Rail Wood Doors.
- G. Section 09 9113 - Exterior Painting: Painting of finish carpentry items.
- H. Section 09 9123 - Interior Painting: Painting of finish carpentry items.
- I. Section 12 3530 - Residential Casework: Shop fabricated cabinet work.

1.02 REFERENCE STANDARDS

- A. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
- B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2016.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- D. Samples: Submit two samples of finish plywood, ___24_x_24___ inch in size illustrating wood grain and specified finish.
- E. Samples: Submit two samples of wood trim 12 inch long.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.
- C. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify adequacy of backing and support framing.

2.02 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.

- B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

2.03 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

2.04 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 9113 and 09 9123.
- C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

2.05 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

**SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Hardware.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 12 3600 - Countertops.
- D. Section 09 9123 - Interior Painting: Field finishing of cabinet exterior.
- E. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).
- C. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
- D. UL (DIR) - Online Certifications Directory Current Edition.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- F. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
- G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2016.
- H. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- I. WI (CCP) - Certified Compliance Program (CCP) Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Wood Veneer Faced Cabinet:
- C. Plastic Laminate Faced Cabinets: Custom grade.
- D. Cabinets at Common Area custom cabinetry:
 - 1. Finish - Exposed Exterior Surfaces: Wood.
 - 2. Finish - Concealed Surfaces: Manufacturer's option.
 - 3. Door and Drawer Front Style : Square edge flat panel..
 - 4. Casework Construction Type: Type B - Face-frame.
 - 5. Interface Style for Cabinet and Door: Style 1 - Overlay; Full Overlay.
 - 6. Cabinet Style: Flush overlay.
 - 7. Cabinet Doors and Drawer Fronts: Flush style.
 - 8. Drawer Side Construction: Multiple-dovetailed.
 - 9. Drawer Construction Technique: Dovetail joints.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 COUNTERTOPS

- A. Countertops are specified in Section 12 3600.

2.04 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
 - 1. Manufacturers:
 - a. Franklin International, Inc; Titebond Original Wood Glue:
www.titebond.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 - 1. Color: As selected by Architect from manufacturer's standard range.
 - 2. Use at all exposed plywood edges.
 - 3. Use at all exposed shelf edges.
- C. Concealed Joint Fasteners: Threaded steel.
- D. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.05 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- C. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch spacing adjustments.
- D. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.

- E. **Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish. At all common area cabinets.**
- F. Catches: Magnetic.
- G. Drawer Slides:
 - 1. Type: Extension types as indicated.
 - 2. Static Load Capacity: Commercial grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Manufacturers:
 - a. Accuride International, Inc: www accuride.com/#sle.
 - b. Grass America Inc: www.grassusa.com.
 - c. Hettich America, LP: www.hettich.com/#sle.
 - d. Knappe & Vogt Manufacturing Company: www.knappeandvogt.com/#sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- H. Hinges: European style concealed self-closing type, steel with polished finish.
 - 1. Manufacturers:
 - a. Grass America Inc; Tiomos Hinge System: www.grassusa.com/#sle.
 - b. Hardware Resources: www.hardwareresources.com/#sle.
 - c. Hettich America, LP: www.hettich.com/#sle.
 - d. Blum, Inc: www.blum.com/#sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.06 SHOP TREATMENT OF WOOD MATERIALS

- A. Provide UL (DIR) listed and approved identification on fire retardant treated material.

2.07 SITE FINISHING MATERIALS

- A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.08 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
 - 1. Provide center matched panels at each elevation.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.09 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

- C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. Stain: As selected by Architect.
 - b. Sheen: Flat.
 - 2. Opaque: (where indicated)
 - a. System - 1, Lacquer, Nitrocellulose.
 - b. Color: As selected by Architect.
 - c. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify field measurements.

3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 2100 THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, over roof sheathing, and exterior wall behind gypsum board wall finish.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- D. Batt insulation in interior wall construction.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.
- B. Section 05 4000 - Cold-Formed Metal Framing: Board insulation as wall sheathing.
- C. Section 06 0573 - Wood Treatment: Field-applied termiticide for wood.
- D. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.
- E. Section 07 2126 - Blown Insulation: Blown-in, gravity-held fibrous insulation.
- F. Section 07 2500 - WEATHER BARRIERS: Separate air barrier and vapor retarder materials.
- G. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- H. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

- A. ASTM C240 - Standard Test Methods for Testing Cellular Glass Insulation Block 2021.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
- C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2021.
- D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- H. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2020.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2014.
- K. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.

- L. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.
- D. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.
- E. Insulation Over Roof Deck: Extruded polystyrene (XPS) board.
- F. Insulation in Interior Wood Frame Walls: Batt Insulation

2.03 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - 2. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
 - 5. R-value; 1 inch of material at 72 degrees F: 5, minimum.
 - 6. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
 - 7. Board Thickness: 1-1/2 inches.
 - 8. Board Edges: Square.
 - 9. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
 - 10. Manufacturers:
 - a. Dow Chemical Company: www.dow.com.
 - b. Owens Corning Corp: www.owenscorning.com.
 - c. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com/#sle.
 - d. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
- B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.

1. Classifications:
 - a. Type II:
 - 1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
 - 2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
 - 3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Water Vapor Permeance: 1.2 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Board Size: 48 inch by 96 inch.
7. Board Thickness: 1.5 inch.
8. Tapered Board: Slope as indicated; minimum thickness as called out on Architectural Drawings ; fabricate of fewest layers possible.
9. Board Edges: Square.
10. Manufacturers:
 - a. Atlas Roofing Corporation; ACFoam-II Polyiso Roof Insulation: www.atlasroofing.com/#sle.
 - b. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: www.carlisleccw.com/#sle.
 - c. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.

2.04 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option; unless specifically indicated one or the other.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 4. Formaldehyde Content: Zero.
 5. Facing: Unfaced.
 6. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corp: www.owenscorning.com.
 7. Substitutions: See Section 01 6000 - Product Requirements.
- C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
 3. Manufacturers:
 - a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
 - b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.

- c. Thermafiber, Inc; SAFB: www.thermafiber.com.
- d. ROCKWOOL (ROXUL, Inc); COMFORTBATT: www.rockwool.com/#sle.
- e. ROCKWOOL (ROXUL, Inc); AFB evo™: www.rockwool.com/#sle.
- f. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

- A. Sheet Vapor Retarder: Specified in Section 07 2500.
- B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.
- C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- D. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- E. Adhesive: Type recommended by insulation manufacturer for application.
- F. Spray foam insulation: Non-expanded foam spray for application into cracks around exterior doors and windows, closely spaced framing members, holes and penetrations.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 GENERAL

- A. Provide complete insulation package for proposed structure including foundation, walls, floors, attics and any assembly exposed to the exterior.
- B. Insulate all crevices at exterior openings and penetrations either with batt insulation or non expanding foam.
- C. Fill all holes in top and bottom wall plates of attics and crawl spaces with nonexpanding foam.

BOARD INSTALLATION AT FOUNDATION PERIMETER

4.01 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install boards horizontally on walls.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

4.02 BOARD INSTALLATION AT CAVITY WALLS

- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

4.03 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

4.04 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

- A. Board Installation Over Roof Deck, General:
 - 1. See applicable roofing specification section for specific board installation requirements.

2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
3. Do not apply more insulation than can be covered with roofing on the same day.

4.05 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over member face.
- F. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.
- G. Tape seal tears or cuts in vapor retarder.
- H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

4.06 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

**SECTION 07 5423
THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Adhered system with thermoplastic polyolefin (TPO) roofing membrane.
- B. Insulation, flat and tapered.
- C. Flashings.
- D. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets and []].

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2012.
- C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2013.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2016.
- E. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing 2013.
- F. NRCA (RM) - The NRCA Roofing Manual 2017.
- G. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's written information listed below.
 - 1. Product data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
- D. Warranty:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Protect products in weather protected environment, clear of ground and moisture.
- C. Protect foam insulation from direct exposure to sunlight.
- D. Provide Safety Data Sheets (SDS) at the project site at all times during transportation, storage, and installation of materials.

- E. Comply with requirements from Owner to prevent overloading or disturbance of the structure when loading materials onto the roof.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 20 years.
 - 2. For repair and replacement include costs of both material and labor in warranty.
 - 3. Include accidental punctures according to the manufacturer's standard warranty terms.
 - 4. Include hail damage according to the manufacturer's standard warranty terms.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Carlisle SynTec: www.carlisle-syntec.com/#sle.
 - 1. Duro-last
 - 2. GAF
 - 3. Johns Manville
 - 4. Mule-Hide Products Company
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING APPLICATIONS

- A. TPO Membrane Roofing: One ply membrane, asphalt adhered, over insulation.
- B. Roofing Assembly Performance Requirements and Design Criteria:
 - 1. Roof Covering External Fire Resistance Classification: Class A when tested per UL 790.
 - 2. Wind Uplift:
 - a. Designed to withstand wind uplift forces calculated with ASCE 7.
 - 3. Insulation Thermal Resistance (R-Value): Provide R-Value over entire roof deck in accordance with local building code requirements.
 - 4. Drainage: No standing water within 48 hours after precipitation.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Single Source Responsibility: Provide and install products from single source.
- B. Membrane:
 - 1. Material: Thermoplastic Polyolefin (TPO) complying with ASTM D6878/D6878M.
 - 2. Reinforcing: Internal fabric.
 - 3. Thickness: 60 mils (0.060 inch), minimum.
 - 4. Sheet Width: Factory fabricated into largest sheets possible.
 - 5. Color: To be selected by Architect from manufacturer's full color range.
 - 6. Product:
- C. Seaming Materials: As recommended by membrane manufacturer.
- D. Flexible Flashing Material: Same material as membrane.
- E. Base Flashing: Provide waterproof, fully adhered base flashing system at all penetrations, plane transitions, and terminations.
- F. TPO Profile Rib: heat welded profile ribs, where indicated on the drawings.

2.04 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: ASTM C1289, Type II, Class 1- Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam.
 - 1. Grade and Compressive Strength: Grade 2, 20 psi (Grade 2, 138 Kpa), minimum.

2.05 ACCESSORIES

1. Prefabricated Flashing Accessories:
 - a. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
 - b. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.
 - c. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.
 - d. Pressure Sensitive Cover Strips: 6 inch wide, 45 mils (0.045 inch) thick, non-reinforced TPO membrane laminated to 35 mils (0.035 inch) thick cured synthetic rubber with pressure sensitive adhesive.
 - e. TPO Pressure Sensitive RUSS:
 - f. Walkway Rolls: Sure-Flex Heat Weldable Walkway Rolls; 80 mils (0.080 inch) thick; gray membrane.
 - g. Miscellaneous Flashing: Non-reinforced TPO membrane; 80 mils (0.080 inch) thick, in manufacturer's standard lengths and widths.
2. Membrane Adhesive: As recommended by membrane manufacturer.
3. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
4. Sealants: As recommended by membrane manufacturer.
5. Cleaner: Manufacturer's standard, clear, solvent-based cleaner.
6. Primer: Manufacturer's recommended product.
7. Edgings and Terminations: Manufacturer's standard edge and termination accessories.
 - a. Snap-On Edge System:
 - b. Anchor Bar Fascia System:
 - c. Drip Edge: Carlisle Sure-Seal Drip Edge.
 - d. Coping:
 - e. TPO Coated Sheet Metal.
 - f. Termination Bar.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION, GENERAL

- A. Clean substrate thoroughly prior to roof application.

3.03 INSTALLATION - GENERAL

- A. Perform work in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Do not apply roofing membrane during unsuitable weather.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.04 MEMBRANE APPLICATION

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive at manufacturer's recommended rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Seam Welding:
 - 1. Seam Welding: Overlap edges and ends and seal seams by heat welding, minimum 2 inches.
 - 2. Cover seams with manufacturer's recommended joint covers.
 - 3. Probe seams once welds have thoroughly cooled. (Approximately 30 minutes.)
 - 4. Repair deficient seams within the same day.
 - 5. Seal cut edges of reinforced membrane after seam probe is complete.
- E. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- F. Coordinate installation of roof drains and sumps and related flashings. Locate all field splices away from low areas and roof drains. Lap upslope sheet over downslope sheet.
- G. Install walkway pads at areas of concentrated traffic and as shown on Drawings. Space pad joints to permit drainage.
- H. Daily Seal: Install daily seal per manufacturers instructions at the end of each work day. Prevent infiltration of water at incomplete flashings, terminations, and at unfinished membrane edges.

3.05 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

**SECTION 07 6200
SHEET METAL FLASHING AND TRIM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., and aluminum wrapped trim / fascias..
- B. Aluminum soffits.
- C. Sealants for joints within sheet metal fabrications.
- D. Precast concrete splash pads.
- E. Preformed metal copings.
- F. Scuppers and Scupper Boxes.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry: Metal flashings embedded in masonry.
- B. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.
- C. Section 06 1000 - Rough Carpentry: Field fabricated roof curbs.
- D. Section 07 3113 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.
- E. Section 07 7100 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.
- F. Section 07 7200 - Roof Accessories: Manufactured metal roof curbs.
- G. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.
- H. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Vibration isolation curbs for mechanical equipment.
- I. Section 23 0548 - Vibration and Seismic Controls for HVAC: Vibration isolation curbs for mechanical equipment.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- I. CDA A4050 - Copper in Architecture - Handbook current edition.

J. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 4" by 4" inch in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.
- B. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; anodized finish of color as selected.
- C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); [.027] gauge gutters and .019 gauge downspouts inch thick
 - 1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.
- D. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal.
- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- F. Sealant: Type as specified in Section 07 9005.
- G. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.04 GUTTER AND DOWNSPOUT FABRICATION

- A. Gutters: 6" SMACNA Type K or Ogee Profile as indicated.
- B. Downspouts: 2-3/4" x 4-1/4" SMACNA Corrugated Rectangular Profile profile.
- C. Accessories: Profiled to suit gutters and downspouts.
 - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
 - 2. Gutter Supports: Spikes and ferrules.
 - 3. Downspout Supports: Straps.
 - 4. Valley splash guards: Prefinished aluminum in same gage as gutters secured to outer edge of 90 degree inside corners at bottom of roof valleys. Secure to inside face of outer gutter edge to form a 90 degree 'L' approximately 6" in height with chamfered top corners.
- D. Splash Pads: Precast concrete or solid plastic type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- E. Downspout Boots: Plastic.
- F. Downspout Extenders: Same material and finish as downspouts.
- G. Seal metal joints.

2.05 PREFORMED PREFINISHED METAL COPING

- A. Coping cap shall be .050" aluminum formed as indicated with allowance for expansion and contraction. Support and fasten to curb with manufacturer's standard chair and cleating system; all fasteners and splice plates concealed. All exposed metal shall be prefinished aluminum coated with full strength Kynar 500 finish with 20 year warranty.
- B. Provide Hickman 'Permasnap Coping' or approved equal.

2.06 ALUMINUM SOFFITS

- A. Provide prefinished fully vented aluminum soffits.
 - 1. Panel width: 16"
 - 2. Thickness: .040"
 - 3. Aluminum Alloy 3105 H28.
 - 4. Color as selected by the Architect.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Comply with drawing details.

- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.
- F. Secure gutters and downspouts in place with concealed fasteners.
- G. Connect downspouts to downspout boots, and grout connection watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

- A. Through-Wall Flashing in Masonry.
- B. Fascia and Cornices at roof eave:
- C. Gutters and Downspouts:
- D. Coping, Cap, Parapet, Sill and Ledge Flashings:
- E. Flashings Associated with Shingle Roofing, including Valley, Hip, Ridge, Eave, Gutter Edge, Gable Edge, Chimney:
- F. Counterflashings at Roofing Terminations (over roofing base flashings):
- G. Counterflashings at Curb-Mounted Roof Items:
- H. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports:

END OF SECTION

**SECTION 07 7200
ROOF ACCESSORIES**

PART 2 PRODUCTS

1.01 ROOF CURBS

- A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
 - 1. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
 - 2. Sheet Metal Material:
 - a. Aluminum: 0.080 inch minimum thickness, with 3003 alloy, and H14 temper.
 - 3. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing system at 1:1 slope; minimum cant height 4 inches.
 - 4. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
 - a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch clearance between curb and metal roof panel flange allowing water to properly flow past curb.
 - b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
 - c. Maintain at least 12 inch clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
 - d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
 - 5. Provide layouts and configurations indicated on drawings.
- B. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
 - 1. Provide preservative treated wood nailers along top of curb.
 - 2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
 - 3. Height Above Roof Deck: 14 inches, minimum.
- C. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
- D. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

1.02 ROOF HATCHES AND VENTS, MANUAL AND AUTOMATIC OPERATION

- A. Roof Hatch Manufacturers:
 - 1. Acudor Products Inc; Galvanized Steel Roof Hatch: www.acudor.com/#sle.
 - 2. Bilco Company; Type TB (various types and special size): www.bilco.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Roof Hatches and Smoke Vents: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
 - 1. Style: Provide flat metal covers unless otherwise indicated.
 - 2. For Ladder Access: Single leaf; 30 by 36 inches.
 - 3. For Ships Ladder Access: Single leaf; 30 by 54 inches.
 - 4. For Stair Access: Single leaf; 30 by 96 inches.
- C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.

1. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
 2. Curb Height: 12 inches from finished surface of roof, minimum.
- D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
 2. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
 3. Gasket: Neoprene, continuous around cover perimeter.
- E. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
 2. Hinges: Heavy duty pintle type.
 3. Hold open arm with vinyl-coated handle for manual release.
 4. Latch: Upon closing, engage latch automatically and reset manual release.
 5. Manual Release: Pull handle on interior.
 6. Locking: Padlock hasp on interior.

END OF SECTION

SECTION 07 8400 FIRESTOPPING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.
- B. Section 07 0553 - Fire and Smoke Assembly Identification.
- C. Section 07 8100 - Applied Fire Protection.
- D. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.02 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020a.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).
- H. ITS (DIR) - Directory of Listed Products current edition.
- I. FM 4991 - Approval Standard for Firestop Contractors 2013.
- J. FM (AG) - FM Approval Guide current edition.
- K. FA (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.
- L. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).
- M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- N. UL (DIR) - Online Certifications Directory Current Edition.
- O. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Sustainable Design Submittal: Submit VOC content documentation for all non-preformed materials.
- E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- G. Certificate from authority having jurisdiction indicating approval of materials used.
- H. Installer Qualification: Submit qualification statements for installing mechanics.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated, ASTM E119, and ASTM E814.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
 - 2. Verification of at least five satisfactorily completed projects of comparable size and type.
 - 3. Licensed by local authorities having jurisdiction (AHJ).
- D. Coordination: Cross-coordinate rated and structural assemblies with penetrating products shown on plans and shop drawings of work by other divisions.

1.05 MOCK-UP

- A. Install one firestopping assembly representative of each fire rating design required on project.
 - 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
- B. If accepted, mock-up will represent minimum standard for the Work.
- C. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manufacturers:
 - 1. A/D Fire Protection Systems Inc.; [____]: www.adfire.com.
 - 2. 3M Fire Protection Products; [____]: www.3m.com/firestop.
 - 3. Hilti, Inc: www.us.hilti.com/#sle.
 - 4. Nelson FireStop Products; [____]: www.nelsonfirestop.com.
 - 5. Specified Technologies, Inc.; [____]: www.stifirestop.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Materials: Use any material meeting requirements.
- C. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- E. Fire Ratings: Refer to drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- B. Membrane Penetration Firestopping: For all membrane penetrations, provide firestopping systems that have been tested according to ASTM E814 to have a pressure differential of .01" of water, and with fire resistance, F and T Rating not less than the required fire rating of penetrated assembly.
- C. For non-standard firestopping applications (including but not limited to plumbing cleanouts, electrical panels, etc) in rated and/or structural bearing walls, provide listed systems with supporting fire engineering determination for modifications as required by the local building and fire authorities.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9005 JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.
- B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 8400 - Firestopping: Firestopping sealants.
- C. Section 09 2116 - Gypsum Board Assemblies: Acoustic sealant.
- D. Section 09 3000 - Tiling: Sealant used as tile grout.

1.03 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants 2017.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2018.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. LEED Report: Submit VOC content documentation for all non-preformed sealants and primers.
- C. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years experience and approved by manufacturer.

1.07 MOCK-UP

- A. Provide mock-up of sealant joints in conjunction with window under provisions of Section 01 4000.
- B. Construct mock-up with specified sealant types and with other components noted.
- C. Locate where directed.
- D. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gunnable and Pourable Sealants:
 - 1. Adhesives Technology Corporation: www.atc.ws.
 - 2. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 3. Bostik Inc: www.bostik-us.com.
 - 4. ARDEX Engineered Cements: www.ardexamericas.com.
 - 5. Dow Corning Corporation: www.dowcorning.com.
 - 6. Hilti, Inc: www.us.hilti.com.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Preformed Compressible Foam Sealers:
 - 1. EMSEAL Joint Systems, Ltd; Product [____]: www.emseal.com.
 - 2. Sandell Manufacturing Company, Inc; Product [____]: www.sandellmfg.com.
 - 3. Dayton Superior Corporation; Product [____]: www.daytonsuperior.com.
 - 4. Tremco Global Sealants; Product [____]: www.tremcosealants.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SEALANTS

- A. Sealants and Primers - General: Provide products having volatile organic compound (VOC) content as specified in Section 01 6116.
- B. General Purpose Exterior Sealant: Silane Modified Polymer (SMP); ASTM C920, Type S, Grade NS, Class 50, Uses Masonry, wood, metal, plastic; single component.
 - 1. Color: Match adjacent finished surfaces.
 - 2. Applications: Use for:
 - a. Control, expansion, and soft joints in masonry.
 - b. Joints between concrete and other materials.
 - c. Joints between metal/wood frames and other materials.
 - d. Joints at vinyl, cementitious or wood siding.
 - e. Other exterior joints for which no other sealant is indicated.
 - 3. Silane Modified Polymer (SMP) Products:
 - a. OSI Quad Max: <http://www.ositough.com>.
- C. Type [____] - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
 - 1. Color: Match adjacent finished surfaces.
 - 2. Applications: Use for:
 - a. Interior wall and ceiling control joints.
 - b. Joints between door and window frames and wall surfaces.
 - c. Other interior joints for which no other type of sealant is indicated.
 - 3. Products:
 - a. Bostik Inc; [____]: www.bostik-us.com.
 - b. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
 - c. BASF Construction Chemicals-Building Systems; [____]: www.buildingsystems.basf.com.
 - d. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
 - e. Tremco Global Sealants; [____]: www.tremcosealants.com.
- D. Bathtub/Tile Sealant: Silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
 - 1. Applications: Use for:
 - a. Joints between plumbing fixtures and floor and wall surfaces.

- b. Joints between kitchen and bath countertops and wall surfaces.
- 2. Color: Match adjacent finished surfaces except at plastic laminate countertops use clear.
- 3. Products:
 - a. Bostik Inc; [____]: www.bostik-us.com.
 - b. BASF Construction Chemicals-Building Systems; [____]: www.buildingsystems.basf.com.
 - c. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com.
 - d. Tremco Global Sealants; [____]: www.tremcosealants.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- E. Type [____] - Acoustical Sealant for Concealed Locations:
 - 1. Composition: Acrylic latex emulsion sealant.
 - 2. Applications: Use for concealed locations only:
 - a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
 - 3. Products:
 - a. Bostik Inc; [____]: www.bostik-us.com.
 - b. Pecora Corporation: www.pecora.com.
 - c. BASF Construction Chemicals-Building Systems; [____]: www.buildingsystems.basf.com.
 - d. Tremco Global Sealants; [____]: www.tremcosealants.com.
 - e. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- F. Type [____] - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
 - 1. Approved by manufacturer for wide joints up to 1-1/2 inches.
 - 2. Color: Match adjacent finished surfaces.
 - 3. Applications: Use for:
 - a. Expansion joints in floors.
 - b. Other floor joints.
 - 4. Products:
 - a. Bostik Inc; [____]: www.bostik-us.com.
 - b. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
 - c. BASF Construction Chemicals-Building Systems; [____]: www.buildingsystems.basf.com.
 - d. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- G. Type [____] - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
 - 1. Color: Gray.
 - 2. Applications: Use for:
 - a. Joints in sidewalks and vehicular paving.
 - b. Expansion joints abutting building..
 - 3. Products:
 - a. Bostik Inc; [____]: www.bostik-us.com.
 - b. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
 - c. BASF Construction Chemicals-Building Systems; [____]: www.buildingsystems.basf.com.

- d. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant:
www.sherwin-williams.com.
- e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width..
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker where joint backing is not used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- H. Tool joints concave.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

**SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Fire-rated hollow metal doors and frames.
- C. Thermally insulated hollow metal doors with frames.
- D. Sound-rated hollow metal doors and frames.
- E. Hollow metal borrowed lites glazing frames.
- F. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 9113 - Exterior Painting: Field painting.
- D. Section 09 9123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI - American National Standards Institute.
- B. ASCE - American Society of Civil Engineers.
- C. HMMA - Hollow Metal Manufacturers Association.
- D. NAAMM - National Association of Architectural Metal Manufacturers.
- E. NFPA - National Fire Protection Association.
- F. SDI - Steel Door Institute.
- G. UL - Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2014.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2015.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2014.
- I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2014.

- J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- K. ITS (DIR) - Directory of Listed Products current edition.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
- N. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames 2007.
- O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2006.
- P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2016.
- Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2012.
- R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.
- S. UL (BMD) - Building Materials Directory; current edition.
- T. UL (DIR) - Online Certifications Directory current listings at database.ul.com.
- U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Samples: Submit two samples of metal, 2 inch by 2 inch in size showing factory finishes, colors, and surface texture.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
 2. De La Fontaine Inc: www.delafontaine.com.
 3. De La Fontaine Inc: www.delafontaine.com.
 4. De La Fontaine Inc: www.delafontaine.com.
 5. Republic Doors: www.republicdoor.com.
 6. Steelcraft, an Allegion brand: www.allegion.com/us.
 7. Technical Glass Products; SteelBuilt Window & Door Systems: www.tgpamerica.com/#sle.
 8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN CRITERIA

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
 - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Hollow Metal Panels: Same construction, performance, and finish as doors.
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
 - 2. Door Thickness: 1-3/4 inch, nominal.
- B. Interior Doors, Non-Fire Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
 - 2. Door Thickness: 1-3/4 inch, nominal.
- C. Fire-Rated Doors:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.

- b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
 - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - b. Attach fire rating label to each fire rated unit.
 - 3. Door Thickness: 1-3/4 inch, nominal.
- D. Type [] , Sound-Rated Interior Doors:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
 - 2. Door Thickness: As required to meet acoustic requirements indicated.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Face welded type.
 - 1. Weatherstripping: Separate, see Section 08 7100.
- C. Interior Door Frames, Non-Fire Rated: Knock-down type.
- D. Door Frames, Fire-Rated: Knock-down type.
 - 1. Fire Rating: Same as door, labeled.
- E. Sound-Rated Door Frames: Knock-down type.
- F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed.
 - 1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
- B. Glazing: As specified in Section 08 8000, factory installed.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.
- D. Verify necessary flashings are in place at exterior doors before installation.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section 08 7100.
- E. Comply with glazing installation requirements of Section 08 8000.
- F. At exterior doors install necessary flashing at head of door appropriate to the detail and adjacent materials.
- G. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

**SECTION 08 1433
STILE AND RAIL HARDBOARD DOORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Interior stile and rail hardboard doors.
 - 2. Shop priming, Factory finishing stile and rail hardboard doors.
 - 3. Factory fitting stile and rail hardboard doors to frames and factory machining for hardware.
- B. Related Sections include the following:
 - 1. Division 6 Section "Finish Carpentry, Interior Architectural Woodwork" for wood door frames.
 - 2. Division 6 Section "Interior Architectural Woodwork" for requirements for veneers from the same flitches for both architectural woodwork and stile and rail hardboard doors.

1.03 SUBMITTALS

- A. Product Data: For each type of door. Include details of construction.
 - 1. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate requirements for veneer matching.
 - 3. Indicate doors to be factory finished and finish requirements.
 - 4. Indicate fire ratings for fire doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification: Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
- E. Product Certificates: Signed by door manufacturers.
- F. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain stile and rail doors through one source from a single manufacturer.
- B. Quality Standard for Doors of Stock Design and Construction: Comply with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," unless more stringent requirements are specified.
 - 1. Mark, label, or otherwise identify stile and rail hardboard doors as complying with WDMA I.S.6, and include panel design number if applicable.
- C. Fire-Rated Wood Doors and Frames: Doors and frames complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in opaque plastic bags or cardboard cartons.
- C. Mark each door on top and bottom edge with opening number used on Shop Drawings.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.07 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, and have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Interior Doors: Five years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Basis-of-Design Product: The design for each stile and rail door is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 MATERIALS

- A. General: Use only materials that comply with referenced quality standards unless more stringent requirements are specified.
 - 1. Assemble interior doors, frames, and sidelites, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and ASTM D 5751 for joints other than finger joints.
- B. Low-Emitting Materials:
 - 1. Provide doors made with adhesives and composite wood products that do not contain urea-formaldehyde resins.
- C. Panel Products: Any of the following:
 - 1. Particleboard made from wood particles, with binder containing no urea-formaldehyde resin, complying with ANSI A208.1, Grade M-2.
 - 2. Particleboard made from straw, complying with ANSI A208.1, Grade M-2.
 - 3. Medium-density fiberboard made from wood fiber, with binder containing no urea-formaldehyde resin, complying with ANSI A208.2, Grade MD.
 - 4. Medium-density fiberboard made from agricultural waste fiber, complying with ANSI A208.2, Grade MD.
 - 5. Hardboard, complying with AHA A135.4.
 - 6. Veneer core plywood, made with adhesive containing no urea-formaldehyde resin.

2.03 STILE AND RAIL DOORS OF STOCK DESIGN AND CONSTRUCTION

- A. Manufacturer – Basis of Design:

1. Molded Panel Safe 'N Sound Series doors as manufactured by Masonite International Corporation with panel configuration as shown on the drawings.
- B. Interior Doors:
1. Door facings are to be bonded to stiles, rails and core forming a 3 ply structural attachment.
 2. Wood Materials for Opaque Finish: Manufacturer's standard materials and cut for stiles and rails; with panels of same species or wood-base construction materials, as standard with manufacturer.
 3. Interior Door Types:
 - a. Raised panel doors both rated and unrated as depicted on the drawings.
- C. Door Frames:
1. Wood jambs shall be fabricated as flat jamb with doorstop applied or 2-piece split jamb. Hinge jamb preparations for 1 3/8" thick doors to be machined for standard weight radius ;mortise 3 1/2" hinges and 1 3/4" doors machined to accept 4" hinges. Strike jamb preparations shall be machined for scheduled hardware.

2.04 INTERIOR FIRE-RATED DOOR FRAMES

- A. Manufacturers:
1. Masonite International Corporation. Safe N' Sound Series.
- B. Frames, complete with casings, fabricated from solid fire-retardant-treated wood or from veneered fire-retardant particleboard, fire-retardant medium-density fiberboard, or mineral board.

2.05 FABRICATION

- A. Fabricate stile and rail hardboard doors in sizes indicated for Project-site fitting.
- B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/2 inch (13 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 3/8 inch (10 mm) from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.
- C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W Series standards, and hardware templates.
1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- D. Glazed Openings: Glaze doors at factory with glass of type and thickness indicated, complying with Division 8 Section "Glazing." Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C 920. Secure glass in place with removable wood stops.
- E. Glazed Openings: Trim openings indicated for glazing with solid wood moldings, with one side removable.
- F. Transom and Side Panels: Fabricate panels to match adjoining doors in materials, finish, and quality of construction.
- G. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.06 SHOP PRIMING

- A. Doors for Opaque Finish: Shop apply one coat of wood primer specified in Division 9 Section "Painting" to faces and edges of doors, including mortises and cutouts.

2.07 FINISHES:

- A. Doors shall receive hardboard facing with manufacturer's prefinished simulated wood grain finish of color as selected by the Architect or Owner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine doors and substrates, with Installer present, for suitable conditions where wood stile and rail doors and fire-rated wood door frames will be installed.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install fire-rated wood door frames level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Countersink fasteners, fill surface flush, and sand smooth.
- B. Hardware: For installation, see Division 8 Section "Door Hardware."
- C. Install wood doors to comply with manufacturer's written instructions and with referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- D. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
- 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.
- G. Field-Finished Doors: Refer to the following for finishing requirements:
 - 1. Division 9 Section "Painting."

3.03 ADJUSTING AND PROTECTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081433

**SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Steel attachment devices.
- B. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.
- C. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- D. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.
- B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2020.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.
- I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).
- J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details. .
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

- E. Samples: Submit two samples 2 x 2 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: See below under description of products.
- B. Aluminum-Framed Storefront and Doors:
 1. C.R. Laurence Company, Inc; U.S. Aluminum; [____]: www.crl-arch.com/#sle.
 2. EFCO Corporation; [____]: www.efcocorp.com/#sle.
 3. YKK AP America Inc: www.ykkap.com.
 4. Kawneer North America; [____]: www.kawneer.com/#sle.
 5. Manko Window Systems, Inc; [____]: www.mankowindows.com/#sle.
 6. United States Aluminum Corp: www.usalum.com.
 7. Oldcastle BuildingEnvelope; [____]: www.oldcastlebe.com/#sle.
 8. Tubelite, Inc; [____]: www.tubeliteinc.com/#sle.
 9. Trulite Glass & Aluminum Solutions, LLC; [____]: www.trulite.com/#sle.
 10. United States Aluminum Corp; [____]: www.usalum.com/#sle.
 11. Tubelite, Inc. 300 ES Energy Saver: www.tubeliteinc.com.
 12. Vitro Architectural Products; CG450S^2: www.vitroamerica.com.
 13. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 1. Glazing Rabbet: For 1 inch insulating glazing.
 2. Glazing Position: Front-set.
 3. Sealed Insulating Glass Units: Vision glazing.
 - a. Application(s): All exterior glazing unless otherwise indicated.
 - b. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - 1) Tint: Clear.
 - 2) Coating: Low-E type, on #2 surface.
 - c. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - 1) Tint: Clear.
 - 2) Coating: None, on #3 surface.
 - d. Total Thickness: 1 inch.

- e. Total Solar Heat Gain Coefficient: 30 percent, nominal.
 - f. Glazing Method: Gasket glazing.
 - 4. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
 - 5. Water Leakage Test Pressure Differential: 8 lbf/sq ft.
 - 6. Air Infiltration Test Pressure Differential: 6.24 psf.
 - 7. Finish: Class II natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - 8. Finish Color: Black Anodized..
 - 9. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 10. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 11. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 12. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 - 13. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 - 14. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements:
- 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of the Building code of state in question.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 - 2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
 - 3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
 - 4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
 - 5. Overall U-value Including Glazing: 32 Btu/(hr sq ft deg F), maximum.
 - 6. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 7. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at specified differential pressure across assembly in accordance with ASTM E283.
 - 8. Water Leakage: None, when measured in accordance with ASTM E331 at specified pressure differential.
 - 9. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 10. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12

hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Glazing Stops: Flush.
 - 3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Swing Doors: Glazed aluminum.
 - 1. Thickness: 1-3/4 inches.
 - 2. Top Rail: 4 inches wide.
 - 3. Vertical Stiles: 4-1/2 inches wide.
 - 4. Bottom Rail: 10 inches wide.
 - 5. Glazing Stops: Square.
 - 6. Finish: Same as storefront.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Glass: As specified in Section 08 8000.
- D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- E. Glazing Accessories: As specified in Section 08 8000.

2.05 FINISHES

- A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
- B. Color: As selected by Architect from manufacturer's standard range.

2.06 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce components internally for door hardware and door operators.
- G. Reinforce framing members for imposed loads.
- H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.

- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Remove excess sealant by method acceptable to sealant manufacturer.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes:
 - 1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
 - 2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
 - 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
- C. Related Sections:
 - 1. Division 01 Section "Alternates" for alternates affecting this section.
 - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
 - 4. Division 26 sections for connections to electrical power system and for low-voltage wiring.
 - 5. Division 28 sections for coordination with other components of electronic access control system.

1.3 REFERENCES

- A. UL - Underwriters Laboratories
 - 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies
 - 4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Type, style, function, size, and finish of each hardware item.

- d. Name and manufacturer of each item.
- e. Fastenings and other pertinent information.
- f. Location of each hardware set cross-referenced to indications on Drawings.
- g. Explanation of all abbreviations, symbols, and codes contained in schedule.
- h. Mounting locations for hardware.
- i. Door and frame sizes and materials.
- j. Name and phone number for local manufacturer's representative for each product.
- k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
 - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

- a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
- b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
- c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
- d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
- e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
- f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

- 1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
- 2. Product Certificates for electrified door hardware, signed by manufacturer:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- 3. Certificates of Compliance:
 - a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
 - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.

- c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
 4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
 5. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:
1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Final approved hardware schedule, edited to reflect conditions as-installed.
 - f. Final keying schedule
 - g. Copies of floor plans with keying nomenclature
 - h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
 - i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
1. Products of Equal Grade to be Acceptable.
 2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 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.
 4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: 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 meets these requirements:
 - 1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 - 2. Can provide installation and technical data to Architect and other related subcontractors.
 - 3. Can inspect and verify components are in working order upon completion of installation.
 - 4. Capable of producing wiring diagrams.
 - 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
 - 2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- I. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
 - 2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.
- K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.
1. Attendees: Owner, Contractor, Architect, Installer, Owner's security consultant, and Supplier's Architectural Hardware Consultant.
 2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- L. Pre-installation Conference: Conduct conference at Project site.
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. Inspect and discuss preparatory work performed by other trades.
 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 4. Review sequence of operation for each type of electrified door hardware.
 5. Review required testing, inspecting, and certifying procedures.
- M. Coordination Conferences:
1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
 2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
 - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Owner's security consultant, Architect and Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 - 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 - 1. Promptly replace products damaged during shipping.
 - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.
- F. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

- a. Closers:
 - 1) Mechanical: 20 years.
 - 2) Electrified: 2 years.
 - b. Locksets:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - c. Continuous Hinges: Lifetime warranty.
 - d. Key Blanks: Lifetime
2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- B. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
 - 1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
 - 2. Use materials which match materials of adjacent modified areas.
 - 3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- D. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:
 - 1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
 - 2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
 - 3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.
 - 4. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.3 HINGES

- A. Provide five-knuckle, ball bearing hinges.
 - 1. Manufacturers and Products:
 - a. Scheduled Manufacturer and Product: Ives 5BB series
 - b. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series
- B. Requirements:
 - 1. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
 - 2. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
 - 3. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
8. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified

2.4 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series
2. Acceptable Equals as Approved

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: Schlage 06A
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.5 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND Series
2. Acceptable Equals as Approved

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1. Cylinders: Refer to "KEYING" article, herein.
2. Provide locksets able to withstand 1500 inch pounds of torque applied to locked outside lever without gaining access per ANSI/BHMA A156.2 Abusive Locked Lever Torque Test and cycle tested to 3 million cycles per ANSI/BHMA A156.2 Cycle Test.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
 - a. Lever Design: Schlage RHO
 - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.6 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Falcon 80/70
2. Acceptable Equals as Approved
IMPORTANT: All closers must be installed with machine or wood screws, Tech screws NOT allowed.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter, with 5/8 inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.7 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Equals as Approved

B. Requirements:

1. Provide heavy duty overhead stop or holder as specified for exterior and interior doors.

2.8 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where wall cannot be used, provide overhead stop.

2.9 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard Products, Pemko

B. Requirements:

1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.10 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.11 FINISHES

- A. Finish: BHMA 626/652 (US26D); except:
1. Hinges at Exterior Doors: BHMA 630 (US32D)
 2. Continuous Hinges: BHMA 628 (US28)
 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
 4. Protection Plates: BHMA 630 (US32D)
 5. Overhead Stops and Holders: BHMA 630 (US32D)
 6. Door Closers: Powder Coat to Match
 7. Wall Stops: BHMA 630 (US32D)
 8. Latch Protectors: BHMA 630 (US32D)
 9. Weatherstripping: Clear Anodized Aluminum
 10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 2. Field modify and prepare existing door and frame for new hardware being installed.
 3. When modifications are exposed to view, use concealed fasteners, when possible.
 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

- c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights 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 WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Furnish permanent cores to Owner for installation.
- I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Testing and labeling wires with Architect's opening number.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

- L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- N. 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 may impede traffic or present tripping hazard.
- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- Q. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three (3) months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets:

Hardware Group No. 1- Typical Interior Door: Office with wall stop.

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	ENTRY / OFFICE LOCK	L9456 BDC 06A	626	SCH
1	EA	PERMANENT CORE	PROVIDED BY CMHA	626	B/O

CMHA Beechwood

1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	SURFACE CLOSER	SC81 RW/PA	689	FAL

Hardware Group No. 2 - Typical Residence Door: Bathroom with overhead stop.

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	AL40S SAT	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	OVERHEAD STOP	450S SERIES		GLJ

Hardware Group No. 3 - Typical Interior Door: Office (no wall stop)

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	ENTRY / OFFICE LOCK	L9456 BDC 06A	626	SCH
1	EA	PERMANENT CORE	PROVIDED BY CMHA	626	B/O
1	EA	SURFACE CLOSER	SC81 RW/PA	689	FAL

Hardware Group No. 4 - Typical Exterior Door: Trash Room

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9456 BDC 06A	626	SCH
1	EA	PERMANENT CORE	PROVIDED BY CMHA	626	B/O
1	EA	LOCK GUARD	LG10	630	IVE
1	EA	SURFACE CLOSER	SC71 DSHO	689	FAL
1	EA	GASKETING	429A	A	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	655A-V3-MSLA-10	A	ZER
1	EA	RAIN DRIP	142A	A	ZER

Hardware Group No. 5 - Typical Residence Door: Closet (with overhead stop)

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	AL10S SAT	626	SCH
1	EA	OVERHEAD STOP	450S SERIES		GLJ

CMHA Beechwood

Hardware Group No. 6 - Typical Existing Door: Single Alum Add ADA Operator

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	AUTO OPERATOR	9540	689	LCN
2	EA	JAMB ACTUATOR	8310-818T AS REQ'D	689	LCN
2	EA	WALL ACTUATOR	8310-853T AS REQ'D	630	LCN

Operational Description

Automatically Opens & Closes Door.

Provide wireless push plate where indicated on plan (A701-05)

Hardware Group No. 7 - Typical Residence Door: Unit Entry

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	D10S RHO	626	SCH
1	EA	DEADBOLT	B660 BD	626	SCH
1	EA	PERMANENT CORE	PROVIDED BY CMHA	626	B/O
1	EA	SURFACE CLOSER	SC81 RW/PA	689	FAL
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	5050B		NG
2	EA	DOOR VIEWER	U698	626	IVE

NOTE: ADD 2 EA ARMOR PLATES AT ADA UNITS K1050 34" X 34" B3E X CSK 32D RO

Hardware Group No. 8 - Typical Residence Door: Bathroom.

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	AL40S SAT	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE

Hardware Group No. 9 - Typical Residence Door: Closet (with wall stop)

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	AL10S SAT	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE

CMHA Beechwood

Hardware Group No. 10 - Typical Residence Door: Closet (no stop)

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	AL10S SAT	626	SCH

Hardware Group No. 11 - Typical Public Door: Laundry/Trash Rooms

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	SURFACE CLOSER	SC81 RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	5050B		NG

Hardware Group No. 12 - Typical Residence Door: Bathroom. (no stop)

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	AL40S SAT	626	SCH

Hardware Group No. 13 -Residence Door: Closet Pair

Each To Have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
2	EA	SINGLE DUMMY TRIM	AL170 SAT	626	SCH
2	EA	ROLLER LATCH	RL30A	626	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE

Hardware Group No. 14 – Provide 1 set:

500	EA	KEY BLANKS	MEDECO X 4 W/OWNERS KEYWAY
50	EA	CORES	MEDECO X 4 W/OWNERS KEYWAY

SECTION 08 8300 MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass mirrors.
 - 1. Annealed float glass.

1.02 REFERENCE STANDARDS

- A. ASTM C1036 - Standard Specification for Flat Glass 2016.
- B. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
- D. GANA (GM) - GANA Glazing Manual 2008.
- E. GANA (SM) - GANA Sealant Manual 2008.
- F. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors) 2011.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

1.05 FIELD CONDITIONS

- A. Do not install mirrors when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.
 - 1. Size: As noted on drawings.

2.02 ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.
- C. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.
- D. Glazing Clips: Manufacturer's standard type.
- E. Mirror Attachment Accessories: Stainless steel clips.

- F. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
- G. Channel Frame where indicated: One piece, channel frame, stainless steel, Type 430, satin finish, 1/2 inch by 1/2 inch by 3/8 inch deep with 90 degree mitered corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for mirrored glazing are correctly sized and within tolerance.
- B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.
- C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.
- B. Set mirrors plumb and level, and free of optical distortion.
- C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.04 CLEANING

- A. Remove wet glazing materials from finish surfaces.
- B. Remove labels after work is complete.
- C. Clean mirrors and adjacent surfaces.

3.05 PROTECTION

END OF SECTION

**SECTION 08 9100
LOUVERS**

PART 2 PRODUCTS

1.01 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

END OF SECTION

**SECTION 09 0561
COMMON WORK RESULTS FOR FLOORING PREPARATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Resilient tile and sheet.
 - 2. Broadloom carpet.
 - 3. Carpet tile.
 - 4. Thin-set ceramic tile and stone tile.
- B. Removal of existing floor coverings.
- C. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- F. Patching compound.
- G. Preparation of new and existing wood-based floors and subfloors for installation of new floor coverings.

1.02 RELATED REQUIREMENTS

- A. Section 01 2200 - Unit Prices: Bid pricing for remediation treatments if required.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices: See Section 01 2200 - Unit Prices.
- B. Unit Price for Remedial Floor Coating or Sheet Membrane: Do not include the cost of the floor coating or underlayment in the base bid; state on the bid form the unit price per square foot for the floor coating or underlayment, installed, in the event such remediation is required.

1.04 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2020a.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 2020.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.06 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.

- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 - 1. Manufacturer's qualification statement.
 - 2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
 - 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 - 4. Manufacturer's installation instructions.
 - 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- D. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary of conditions encountered.
 - 3. Moisture and alkalinity (pH) test reports.
 - 4. Copies of specified test methods.
 - 5. Recommendations for remediation of unsatisfactory surfaces.
 - 6. Product data for recommended remedial coating.
 - 7. Include certification of accuracy by authorized official of testing agency.
 - 8. Submit report to Architect.
 - 9. Submit report not more than two business days after conclusion of testing.
- E. Adhesive Bond and Compatibility Test Report.

1.07 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 - 1. Provide access for and cooperate with testing agency.
 - 2. Confirm date of start of testing at least 10 days prior to actual start.
 - 3. Allow at least 4 business days on site for testing agency activities.
 - 4. Achieve and maintain specified ambient conditions.
 - 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.09 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
 - 3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Preliminary cleaning.
 - 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 5. Specified remediation, if required.
 - 6. Patching, smoothing, and leveling, as required.
 - 7. Other preparation specified.
 - 8. Adhesive bond and compatibility test.
 - 9. Protection.

3.02 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.03 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

3.04 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.05 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
- C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
- D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.06 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.07 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.08 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.09 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

- A. Install in accordance with sheet membrane manufacturer's instructions.

3.10 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

**SECTION 09 2116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Gypsum sheathing.
- C. Cementitious backing board.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.
- F. Textured finish system.
- G. Water-resistive barrier over exterior wall sheathing.

1.02 RELATED REQUIREMENTS

- A. Section 07 2100 - Thermal Insulation: Acoustic insulation.

1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
- C. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.
- D. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.
- F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2020.
- I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- J. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- K. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
- L. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2018.
- M. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets 2017.
- N. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2019.
- O. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

- P. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).
- Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- R. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- S. ASTM E413 - Classification for Rating Sound Insulation 2016.
- T. GA-216 - Application and Finishing of Gypsum Panel Products 2016.
- U. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association 2016.
- V. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum [] years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- E. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company; []: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation; []: www.certainteed.com/#sle.

3. Georgia-Pacific Gypsum; [____]: www.gpgypsum.com/#sle.
 4. Lafarge North America Inc: www.lafargenorthamerica.com.
 5. National Gypsum Company; [____]: www.nationalgypsum.com/#sle.
 6. PABCO Gypsum; [____]: www.pabco gypsum.com/#sle.
 7. Temple-Inland Building Product by Georgia-Pacific, LLC: www.temple.com.
 8. USG Corporation; [____]: www.usg.com/#sle.
 9. No foreign manufacturers permitted.
 10. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 - a. Use Glass-mat faced gypsum panels above shower surrounds from top of surround to ceiling.
 3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 4. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 5. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 6. Glass-Mat-Faced Products (non paper faced):
 - a. Georgia-Pacific Gypsum; DensArmor Plus.
 - b. Temple-Inland Building Product by Georgia-Pacific, LLC; GreenGlass Interior Gypsum Board.
 - c. National Gypsum Company; Gold Bond eXP Fire-Shield Interior Extreme Gypsum Panel.
 - d. La Farge Weather Defense Platinum Interior Panels..
- C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including bathrooms without showers..
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch.
 - b. Products:
 - 1) Custom Building Products; [____]: www.custombuildingproducts.com/#sle.
 - 2) National Gypsum Company; PermaBase Brand Cement Board.
 - 3) National Gypsum Company; PermaBase Flex Brand Cement Board.
 - 4) USG Corporation; [____]: www.usg.com/#sle.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
 4. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
 - a. Thickness: 1/2 inch.
 - b. Products:
 - 1) James Hardie Building Products, Inc; [____]: www.jameshardie.com/#sle.

5. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Regular Type: Thickness 1/2 inch.
 - b. Fire Resistant Type: Type X core, thickness 5/8 inch.
 - c. Products:
 - 1) Georgia-Pacific Gypsum; DensShield Tile Backer.
 - 2) National Gypsum Company; Gold Bond eXP Tile Backer.
 - 3) Temple-Inland Building Product by Georgia-Pacific, LLC; GreenGlass Tile Backer.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. Edges: Tapered.
 3. Products:
 - a. American Gypsum Company; M-Bloc.
 - b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
 - c. Georgia-Pacific Gypsum; DensArmor Plus.
 - d. National Gypsum Company; Gold Bond XP Gypsum Board.
- E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: as indicated on drawings .
 3. Edges: Tapered.
- F. Exterior Sheathing Board **and board at shower enclosure walls and ceilings for a distance of 4' from back wall:** Sizes to minimize joints in place; ends square cut.
 1. Application: Exterior sheathing, unless otherwise indicated.
 2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
 3. Core Type: Type X, as indicated.
 4. Type X Thickness: 5/8 inch.
 5. Edges: Square.
 6. Glass Mat Faced Products:
 - a. CertainTeed Corporation; GlasRoc Brand.
 - b. Georgia-Pacific Gypsum; DensGlass Sheathing.
 - c. National Gypsum Company; Gold Bond eXP Sheathing.

2.03 ACCESSORIES

- A. Acoustic Insulation: {rs\#1}; preformed glass fiber, friction fit type, unfaced.
- B. Acoustic Insulation: As specified in Section 07 2100.
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- D. Water-Resistive Barrier: No. 15 asphalt felt.
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 3. Ready-mixed vinyl-based joint compound.
 4. Powder-type vinyl-based joint compound.
 5. Chemical hardening type compound.
 6. Joint Compound: Setting type, field-mixed.

- F. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- G. Textured Finish Materials: Latex-based compound; plain.
 - 1. Primer: Of type recommended by texture finish manufacturer.
 - 2. USG Sheetrock Brand Ceiling Spray Texture-QT Poly, medium polystyrene aggregate.
- H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 - 1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- G. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.
- H. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.
 - 2. Double-Layer Application: Install base layer using screws. Install face layer using adhesive.
- I. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.

3.05 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- E. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-216.
 - 1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
 - 2. Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
 - 3. Level 3 for gypsum board surfaces to receive medium texture.
 - 4. Level 4 for gypsum board surfaces to be painted flat or to receive wallcoverings.
 - 5. Level 5 for gypsum board surfaces to be painted gloss or semi-gloss.
- F. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- G. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 PENETRATIONS

- A. Fill openings created by penetrating items in unrated assemblies and draftstopping. Where exposed, finish to match level of remaining wall.

3.07 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 3000 TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Ceramic trim.
- E. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 03 5400 - Cast Gypsum Based Underlayment.
- B. Section 07 1300 - Sheet Waterproofing.
- C. Section 07 9005 - Joint Sealers.
- D. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- E. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.
- C. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- D. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- E. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement 1999 (Reaffirmed 2016).
- F. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.
- G. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive 2009 (Revised).
- H. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- I. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy 1999 (Reaffirmed 2010).
- J. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2010).
- K. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2010).

- L. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
- M. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- N. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.
- O. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- P. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2016).
- Q. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2020.
- R. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).
- S. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).
- T. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- U. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.
- V. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.
- W. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.
- X. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2012.
- Y. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2019.
- Z. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- AA. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Samples: submit two samples of each color as selected by architect
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Common Areas & Resident Units:
 - 1. Manufacturers: As indicated on the drawings. .
 - a. American Olean Corporation: www.americanolean.com/#sle.
 - b. Dal-Tile Corporation: www.daltile.com/#sle.
 - c. Emser Tile, LLC: www.emser.com/#sle.
 - 2. Glazed Wall Tile: ANSI A137.1 standard grade.
 - a. Color(s): As indicated on drawings.
 - b. Pattern: As indicated on drawings.
 - c. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.
 - 3. Porcelain Tile: ANSI A137.1 standard grade.
 - a. Color(s): As indicated on drawings.
 - b. Pattern: As indicated on drawings.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
 - 1. Manufacturers: Same as for tile.
- B. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Applications:
 - a. Open edges of wall tile.
 - b. Open edges of floor tile.
 - c. Wall corners, outside and inside.
 - d. Transition between floor finishes of different heights.
 - e. Thresholds at door openings.
 - f. Expansion and control joints, floor and wall.
 - g. Floor to wall joints.
 - h. Borders and other trim as indicated on drawings.
 - 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.

- B. Manufacturers:
 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 2. Bostik Inc: www.bostik-us.com/#sle.
 3. Custom Building Products: www.custombuildingproducts.com/#sle.
 4. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
 5. LATICRETE International, Inc: www.laticrete.com/#sle.
 6. Mapei: www.mapei.com
- C. Provide setting materials made by the same manufacturer as grout.
- D. Latex-Portland Cement Mortar Bond Coat:
 1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
 2. Products:
 - a. ARDEX Engineered Cements; ARDEX X 77 MICROTEC: www.ardexamericas.com.
 - b. AVM Industries, Inc; Thin-Set 780: www.avmindustries.com.
 - c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com.
 - d. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com/sle.
 - e. ProSpec, an Oldcastle brand; Permalastic System: www.prospec.com.

2.04 GROUTS

- A. Manufacturers:
 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 2. ProSpec, an Oldcastle brand; ProColor Sanded Tile Grout: www.prospec.com.
 3. Bostik Inc: www.bostik-us.com/#sle.
 4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 5. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: www.merkrete.com/#sle.
 6. Mapei; www.mapei.com.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 3. Color(s): As indicated on drawings.
 4. Products:
 - a. ARDEX Engineered Cements; ARDEX FG-C MICROTEC: www.ardexamericas.com.
 - b. Bostik Inc: www.bostik-us.com.
 - c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 - d. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/#sle.
 - e. ProSpec, an Oldcastle brand; ProColor Sanded Tile Grout: www.prospec.com.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 1. Applications: Where indicated.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Products:
 - a. Bostik Inc: www.bostik-us.com.

- b. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
 - c. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
 - d. ProSpec, an Oldcastle brand; B-7000 Epoxy Mortar and Grout: www.prospec.com.
 - e. Stuart Dean Company, Inc; Marcoat GS: www.stuartdean.com/#sle.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- D. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
- 1. Applications: throughout.
 - 2. Products:
 - a. ProSpec, an Oldcastle brand; ProColor Stain Guard Grout Additive: www.prospec.com.
 - b. H.B. Fuller Construction Products Inc. Grout Boost Advanced Pro; www.groutboost.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- E. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
- 1. Applications: Between tile and plumbing fixtures.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com.
 - b. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com.
 - c. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com.
 - d. ProSpec, an Oldcastle brand; ProColor Advantage Caulk: www.prospec.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- F. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
- 1. Composition: Water-based colorless silicone.
 - 2. Color(s): As selected by Architect from manufacturer's full line.

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 - 1. Applications: Between tile and plumbing fixtures.
 - 2. Color(s): As selected by Architect from manufacturer's full line.
- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
 - 1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Thickness: 20 mils, maximum.
 - 2. Crack Resistance: No failure at 1/8 inch gap, minimum.
 - 3. Products:
 - a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
 - b. Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

- B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 - 1. Type: Bonded Sheet Membrane.
- C. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners. See Section 092116.
- D. Coated Glass Mat Backer Board: ASTM C1178/C1178M, with coated inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder. See Section 092116.
- E. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with standard grout.
- B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
 - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
- C. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
- D. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

- A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.
- B. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.
- C. Grout with standard grout as specified above.
- D. Seal joints between tile work and other work with silicone type sealant specified in Section 07 9005.

3.06 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
- C. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
- D. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.

3.07 CLEANING

- A. Clean tile and grout surfaces.

3.08 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100 ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 2100 - Thermal Insulation: Acoustical insulation.
- C. Section 08 3100 - Access Doors and Panels: Access panels.
- D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.
- E. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- F. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.
- G. Section 27 5116 - Public Address Systems: Speakers in ceiling system.
- H. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2020.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.
- E. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.
- F. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

1.05 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. Acoustic Ceiling Products, Inc: www.acpideas.com.
 - 3. CertainTeed Corporation: www.certainteed.com.
 - 4. USG: www.usg.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. Manufacturers:
 - 1. Acoustical Tile: Basis-of-Design Product: Subject to compliance with requirements, provide tile to match existing, or comparable product by one of the following
 - 2. Acoustical Tile: Basis-of-Design Product: Subject to compliance with requirements, provide tile to match existing, or comparable product by one of the following
 - a. Basis of Design Armstrong World Industries, Inc: www.armstrong.com.
 - b. Acoustic Ceiling Products, Inc.: www.acpideas.com.
 - c. CertainTeed Corporation: www.certainteed.com.
 - d. USG: www.usg.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Acoustical Units - General: ASTM E1264,type III Class A.
 - 1. Flame Spread Rating: 25 or less (ASTM E84). To meet Federal Spec. SS-S-118a, Class 25.
 - 2. Comply with "Acoustical and Insulating Materials Association" (AIMA) "Performance Data Bulletin".
 - 3. Provide panels that are sag resistant and manufactured for environment with humidity levels up to 100%.
 - 4. Edge: Beveled tegular.
 - 5. Surface Color: White.
 - 6. VOC Content: Certified as Low Emission by one of the following :
 - a. GreenGuard Children and Schools; www.greenguard.org.
 - b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.

2.03 SUSPENSION SYSTEM(S)

- A. Manufacturers:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. Acoustic Ceiling Products, Inc.: www.acpideas.com.
 - 3. CertainTeed Corporation: www.certainteed.com.
 - 4. Chicago Metallic Corporation: www.chicagometallic.com.
 - 5. Hunter Douglas Contract: www.hunterdouglascontract.com.
 - 6. USG: www.usg.com.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.

1. Finish: White painted.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.
 1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, and ASTM E580/E580M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 1. Use longest practical lengths.
- E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.
- K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 1. Use longest practical lengths.
 2. Overlap and rivet corners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.

- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.

3.05 ATTIC STOCK

- A. Provide one additional box of replacement acoustical ceiling tile to the owner for future use.

3.06 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

**SECTION 09 6500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Resilient stair accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- B. ASTM E2179 - Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors 2003 (Reapproved 2016).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
- D. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).
- E. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing 2004 (Reapproved 2014).
- F. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- G. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- H. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering 2018.
- I. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- J. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant; Federal Specifications and Standards; Revision E, 1994.
- K. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.
- L. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Verification Samples: Submit two samples, 6 x 9 inch in size illustrating color and pattern for each resilient flooring product specified. For heat welding rod, submit manufacturer's standard size, but not less than 9 inches long, of each color specified.

- F. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.
- G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- H. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- I. Manufacturer's Qualification Statement.
- J. Installer's Qualification Statement.
- K. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. Vinyl Composition Tile (VCT): Homogeneous, with color extending throughout thickness, and:
 1. Manufacturers:
 - a. Armstrong Flooring, Inc; Excelon SDT: www.armstrongflooring.com/#sle.
 2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
 4. Size: 12 by 12 inch.
 5. Thickness: 0.125 inch.
 6. Color: As indicated on drawings.
- B. Luxury Vinyl Tile (LVT) A.K.A. Vinyl Plank (VP):
 1. Common Areas (see finish schedule for locations): Patcraft Timber Grove II Mooreland WPC Core 20 mil wear layer.
 2. Resident Units: Patcraft, Timber Grove II Mooreland 20 mil wear layer gluedown

3. Contact Manufacturer's Representative: Tom Conway 503-307-4592, tom.conway@patcraft.com.

C. Feature Strips: Of same material as tile.

2.02 STAIR COVERING

A. Stair Tread / Riser Combination: Rubber tread with integrated riser for the visually impaired; full width and depth of stair tread in one piece; tapered thickness; nosing not less than 1-5/8 inch deep. Basis of Design is Tarkett. Product: Standard raised round tread/riser. Other equivalent products are acceptable subject to approval from the Architect:

1. Manufacturers:
 - a. Burke Flooring; Endura Stair Treads: www.burkeflooring.com/#sle.
 - b. Tarkett; www.tarkett.com
 - c. Roppe Corp: www.roppe.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
2. Minimum Requirements: Comply with FS RR-T-650 requirements corresponding to type specified.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
4. Nominal Thickness: 0.1875 inch.
5. Nosing: Square.
6. Striping: 2 inch wide contrasting color abrasive strips.
7. Texture: to be reviewed by Architect from manufacturer's full range of textures..
8. Color: As indicated on drawings.

2.03 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.

1. Manufacturers:
 - a. Burke Flooring; Commercial Wall Base - TS: www.burkeflooring.com/#sle.
 - b. Tarkett; www.tarkett.com
 - c. Roppe Corp: www.roppe.com/#sle.
 - d. Patcraft; <https://www.patcraft.com/app/Accessories>.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
2. Height: 4 inch.
3. Thickness: 0.125 inch.
4. Finish: Satin.
5. Color: As indicated on drawings.
6. Accessories: Premolded external corners and internal corners.

2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: As indicated on drawings..
 1. Manufacturers:
 - a. Burke Flooring; Mercer Vinyl Mouldings: www.burkeflooring.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Filler for Coved Base: Plastic.
- E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 09 0561.
 - 2. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 - 3. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation: Install in accordance with manufacturer's written instructions.
- D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.
- E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
 - 2. Resilient Strips: Attach to substrate using adhesive.
- G. Spread only enough adhesive to permit installation of materials before initial set.
- H. Fit joints and butt seams tightly.
- I. Set flooring in place, press with heavy roller to attain full adhesion.
- J. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- K. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

- L. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- M. Install feature strips where indicated.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.06 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

**SECTION 09 9000
PAINTING AND COATING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Walls, ceilings, base trim, casings, doors and frames.
 - 2. On roof where visible paint all pipes, ducts and chimneys that penetrate the roof to match roof color.
 - 3. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 4. Elevator pit ladders.
 - 5. Exposed surfaces of steel lintels and ledge angles.
 - 6. Prime surfaces to receive wall coverings.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically so indicated.
 - 8. Ceramic and other tiles.
 - 9. Glass.
 - 10. Acoustical materials, unless specifically so indicated.
 - 11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01 3515 - LEED Certification Procedures: LEED rating system definition.
- B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- C. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).
 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Extra Paint and Coatings: 1 gallon of each color.
 3. Label each container with color in addition to the manufacturer's label.
 4. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Sherwin-Williams. Standards for interior and exterior paint specifications are through Sherwin-Williams. The Promar 200 Zero VOC series of products are the core standard for interior painting. The A-100 series of products are the core standards for exterior painting.

- C. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
- D. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- E. Transparent Finishes:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- F. Stains:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- G. Primer Sealers: Same manufacturer as top coats.
- H. Block Fillers: Same manufacturer as top coats.
- I. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.
 - 2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
 - 3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - INTERIOR

- A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up, Cast-In-Place)
- B. Latex Systems
 - 1. Gloss
 - a. 1st Coat: S-W Loxon Concrete & Masonry Primer A24W8300 (7 mils wet, 3 mils dry)
 - b. 2nd Coat: S-W ProMar® 400 Latex Gloss B21W400 Series
 - c. 3rd Coat: S-W ProMar® 400 Latex Gloss B21W400 Series (4 mils wet, 1.5 mils dry per coat)
- C. Concrete Stain (Water Base)
 - 1. Flat Finish Opaque

- a. 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
 - b. 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-300 sq/ft per gallon)
- D. CONCRETE- FLOORS
- 1. Acrylic System
 - a. Gloss Finish
 - 1) 1st Coat: S-W Porch & Floor Enamel, A32-100 series
 - 2) 2nd Coat: S-W Porch & Floor Enamel, A32-100 series (4 mils wet, 1.4 mils dry)
 - 3) Alternate
 - 4) 1st Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series
 - 5) 2nd Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series (14-18 mils wet per coat)
 - 2. Concrete Stain (Water Base)
 - a. Low Luster Finish Opaque
 - 1) 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
 - 2) 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-300 sq/ft per gallon)
- E. METAL - (Aluminum, Galvanized)
- 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W ProMar® 400 Latex Gloss Enamel, B21W400 Series
 - 3) 3rd Coat: S-W ProMar® 400 Latex Gloss Enamel, B21W400 Series (4 mils wet, 1.5 mils dry per coat)
 - b. Semi-Gloss Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Semi-Gloss B31W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
 - c. Block Resistant Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W ProClassic® Waterborne Acrylic Semi-Gloss Enamel, B31 Series
 - 3) 3rd Coat: S-W ProClassic® Waterborne Acrylic Semi-Gloss Enamel, B31 Series (4 mils wet, 1.3 mils dry per coat)
 - d. Eg-Shel / Satin Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Eg-Shel B20W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Eg-Shel B20W4600 (4 mils wet, 1.5 mils dry per coat)
 - e. Flat Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Flat B30W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Flat B30W4600 (4 mils wet, 1.4 mils dry per coat)
 - 2. Alkyd / Acrylic Systems

- a. Gloss Finish (Water base)
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2.0 - 4.0 mils dry per coat)
 - 2) 2nd Coat: S-W Waterbased Industrial Enamel, B53-300 Series
 - 3) 3rd Coat: S-W Waterbased Industrial Enamel, B53-300 Series (4 mils wet, 1.6 mils dry per coat)
 - b. Semi-Gloss Acylic / Alkyd Finish
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
 - 2) 2nd Coat: S-W -ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200
 - 3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200 (4 mils wet, 1.7 mils dry per coat)
- F. WOOD- (Walls, Ceilings, Doors, Trim,)
- 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W PrepRite® ProBlock Latex. B51 Series (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series
 - 3) 3rd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series (4 mils wet, 1.5 mils dry per coat)
 - b. Semi-Gloss Finish
 - 1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Semi-Gloss B31W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
 - c. Eg-Shel / Satin Finish
 - 1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Eg-Shel B20W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Eg-Shel B20W4600(4 mils wet, 1.5 mils dry per coat)
 - d. Flat Finish
 - 1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Flat B30W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Flat B30W4600(4 mils wet, 1.4 mils dry per coat)
 - 2. Alkyd Systems
 - a. Gloss Finish (Water base)
 - 1) 1st Coat: S-W Premium Wall & Wood Primer B28W8111 (4 mils wet, 1.6 mils dry)
 - 2) 2nd Coat: S-W Waterbased Industrial Enamel, B53-300 Series
 - 3) 3rd Coat: S-W Waterbased Industrial Enamel, B53-300 Series (4 mils wet, 1.6 mils dry per coat)
 - b. Semi-Gloss (Solvent base) Finish
 - 1) 1st Coat: S-W Premium Wall & Wood Primer B28W8111 (4 mils wet, 2 mils dry)
 - 2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200
 - 3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200(4 mils wet, 1.7 mils dry per coat)
 - 3. At Wood Handrails:

- a. 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
 - b. 2nd and 3rd Coat: S-W B65W181 Hydrogloss Single Component Water Base Urethane
- G. DRYWALL (Walls, Ceilings, Gypsum Board, Plaster Board, etc.)
- 1. Latex Systems
 - a. Gloss Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series
 - 3) 3rd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series (4 mils wet, 1.5 mils dry per coat)
 - b. Semi-Gloss Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Semi-Gloss B31W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
 - c. Eg-Shel / Satin Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Eg-Shel B20W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Eg-Shel B20W4600(4 mils wet, 1.6 mils dry per coat)
 - d. Flat Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W Promar 200 Zero VOC Latex Flat B30W4600
 - 3) 3rd Coat: S-W Promar 200 Zero VOC Latex Flat B30W4600 (4 mils wet, 1.4 mils dry per coat)
 - 2. Alkyd Systems
 - a. Semi- Gloss Finish (Solvent Base)
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200
 - 3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi-Gloss B34-8200(4 mils wet, 1.7 mils dry per coat)
 - b. Eg-Shel / Satin Finish
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
 - 2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Eg-Shel B33-8200
 - 3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Eg-Shel B33-8200 (4 mils wet, 1.8 mils dry per coat)

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of coatings until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing coatings that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- J. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- M. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and

cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- E. Sand wood surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finished coatings until completion of project.
- B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 10 1400 SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.
- B. Interior directional and informational signs.
- C. Emergency evacuation maps.
- D. Building identification signs.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. **Signage Schedule:** Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit one sample, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Stratus style, brushed silver as manufactured by Intersign Corporation, Chatanooga Tn.
 - 1. Columbus Sign Co.
 - 2. Best Sign Systems, Inc: www.bestsigns.com/#sle.
 - 3. FASTSIGNS: www.fastsigns.com/#sle.
 - 4. Inpro: www.inprocorp.com/#sle.

2.02 SIGNAGE APPLICATIONS

- A. Verify sign list, quantity and exact verbiage with Owner through Architect with the submittal process prior to fabrication.
- B. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
 - 1. All signs shall comply with ADA 703 Guidelines.
 - 2. Raised characters must be 48 inches minimum above the floor, measured to the baseline of the lowest raised character and 60 inches maximum above the floor, measured to the baseline of the highest raised character. ANSI 703.3.11.
 - 3. Grade 2 braille dots to comply with ADA Guideline 703.3
 - 4. Braille must be 48 inches minimum and 60 inches maximum above the floor, measured to the baseline of the braille cell. ANSI 703.4.5.
 - 5. Comply with ADA section 703.1; regarding character dimensions, proportions and spacing
 - 6. Comply with section 703.5; finishes shall be non-glare and contrast with their background with either light characters on dark background or dark characters on a light background
- C. At each door to an egress stairway, exit passageway and exit discharge, provide a tactile sign stating EXIT and complying with ICC A117.1. Provide sign adjacent to each door to an egress stairway, an exit passageway and the exit discharge.
- D. At areas for assisted rescue, signage shall be provided as follows:
 - 1. Each door providing access to an area of refuge from an adjacent floor area shall be identified by a sign complying with ICC A117.1, Section 1009.11 and OBC 111.3 stating: AREA OF REFUGE, and including the International Symbol of Accessibility.
 - 2. In the area of refuge and exterior areas for assisted rescue instruction on the use of the area under emergency conditions must be posted. Signage must comply with ICC A117.1 requirements for visual characters. The instructions must include all of the following.
 - a. Persons able to use the exist stairway do so as soon as possible, unless they are assisting others.
 - b. Information on planned availability of assistance in the use of stairs or supervised operations of elevators and how to summon such assistance.
 - c. Directions for use of the two-way-communication system where provided.
- E. Provide and post in a conspicuous place in each section and on each floor of the facility and emergency evacuation sign showing the floor plan indicating all exits and designating egress route from location of sign. Comply with requirements of local code officials.
- F. Provide stairway floor number signs.
- G. A sign shall be provided at each floor landing in interior vertical exit enclosures connecting more than three stories designating the floor level, terminus of the top and

bottom of the stair enclosure and the identification of the stair. The signage shall also state the story of, and the direction to the exit discharge and the availability of roof access from the stairway for the fire department. The sign shall be located 5 feet above the floor landing in a position which is readily visible when the doors are in the open and closed positions.

- H. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. URN - Unit Room Number Sign 3.5"X4"
 - 2. SID - Stair Identification sign 9.5"X7.75"
 - 3. ICF - In Cas of Fire sign 11"X7"
 - 4. EM - Evacuation Map sign 11.5"X11"
 - 5. SCID - Stair Core level ID sign 11.75"X10"
 - 6. EX - Exit Sign 3.5"X4"
 - 7. RSS - Typical room signs 3"X8"
 - 8. RR - restroom signs 9.625"X8"
 - 9. DWS - directional sign 10"X11"
 - 10. IRD - insert room sign 11.5"X11"
 - 11. Unit Doors: All unit door signage is to be noted with numerals only.
 - 12. Office Doors: Identify with room names and numbers to be determined later, not those shown on the drawings; in addition, provide "window" section for replaceable occupant name.
 - 13. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
 - 14. Hot Room: provide "window" section with sliding "In Use/Vacant" indicator.
 - 15. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 16. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.
 - 17. When signs are installed on glass provide matching panel to adhere to the backside. Panel to be same size and shape as room sign in color.
- I. Laundry/Fitness: Provide signage that states USE AT YOUR OWN RISK.
- J. Emergency Evacuation Maps:
- K. Building Identification Signs:

2.03 ACCESSORIES

- A. Tape Adhesive: Double sided tape, permanent adhesive.
 - 1. Applied to sign back by signage manufacturer
 - 2. Mounting surfaces to be fully cured per paint manufacturer's instructions, clean, smooth and free of debris.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Locate signs where indicated:
 - 1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.

- E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

**SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Accessories for toilet rooms.
- D. Grab bars.

1.02 RELATED REQUIREMENTS

- A. Section 08 8300 - Mirrors: Other mirrors.
- B. Section 09 3000 - Tiling: Ceramic washroom accessories.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- C. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2009).
- D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- G. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.
- H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. AJW Architectural Products: www.ajw.com/#sle.
 - 2. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 3. Bradley Corporation: www.bradleycorp.com/#sle.
 - 4. Bobrick Corporation: www.bobrick.com/#sle. [_____].
- B. Residential Toilet, Shower, and Bath Accessories:
 - 1. Basis of Design: Franklin Brass - Kinley Series..

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Living Units: (unless otherwise noted items listed are Franklin Brass Kinley Series)
 - 1. Medicine Cabinet: Broan 615.
 - 2. Towel Bars (not over 30" in length): KIN24-SN.
 - 3. Toilet paper Holder - KIN62-SN; KIN20-SN.
 - 4. Robe Hook - Sunrise Collection 01-322 by Taymor.
 - 5. Shower Curtain rod - Franklin Brass 161-5.
 - 6. Grab bars - Franklin Brass 1 1/2" diameter (powder coated) with snap flanges (concealed fasteners).
 - a. At retrofit conditions provide Franklin Brass grab bar anchor for non-stud mount #FB549.
 - 7. Shower Seats: Surface Mounted Retractable Shower Seat, 3/4" thick, one-piece high density white polymer.
 - a. Built in shower seats: Reversible folding shower seat and frame; phenolic resin seat with 304 stainless steel brackets. Provide Franklin Brass 5181.
 - 8. Provide a weighted shower curtain in all roll in shower units. Provide "Premium Shower Curtain" by by Clarion Bathware; 16273 Rte 208; Marble PA 16334; Telephone: 814-782-3016.
 - 9. Mirror: 1/4" plate glass mirror with pencil edge; size per plans.
- B. Public Bathrooms:
 - 1. Paper towel dispenser - Bobrick B-262
 - 2. Paper towel dispenser / waste receptacle - AJ Washroom U626
 - 3. Paper Holders - Sunrise Collection 01-322 by Taymor
 - 4. Robe Hook - Franklin Brass Century 5502SF.
 - 5. Wall Mounted Soap Dispenser - Franklin Brass 1920, Satin.
 - 6. Grab bars - Franklin Brass 1 1/2" diameter (powder coated) with snap flanges (concealed fasteners).
 - 7. Mirror, 1/4" plate glass - size per plans.

2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers:
 - 1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
 - 2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.

3. Color: White.

2.06 ATTIC STOCK

- A. Supply the following as "attic stock" to the owner at the conclusion of the project:
 1. Two sets of bath accessories provided in apartments and one set of bath accessories provided in the common area restrooms.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
- D. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

3.03 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

**SECTION 10 5723
CLOSET AND UTILITY SHELVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted wire closet shelving.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Blocking in walls for attachment of shelving.
- B. Section 09 2116 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.
- C. Shop Drawings: Provide drawings prepared specifically for this project; show dimensions of shelving and attachment to substrates.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.
- C. Store flat to prevent warpage and bending.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wire Storage Shelving:
 - 1. ClosetMaid Corporation : www.closetmaid.com/#sle.
 - 2. Schulte Corporation - ventilated
 - 3. Organized Living; freedomRail: www.organizedliving.com.
 - 4. RubberMaid Closet and Organization Products : www.rubbermaidcloset.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHELVING APPLICATIONS

- A. Shelf Depth: 12 inches, unless otherwise indicated.

2.03 MATERIALS

- A. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with all components and connections required to produce a rigid structure that is free of buckling and warping.
 - 1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
 - 2. Coating: PVC or epoxy, applied after fabrication, covering all surfaces.
 - 3. PVC Coating: 9 to 11 mils thick.
 - 4. Epoxy Coating: Non-toxic epoxy-polyester powder coating baked-on finish, 3 to 5 mils thick.
 - 5. Standard Mesh Shelves: Cross deck wires spaced at 1 inch.

- B. Hanging Rod: Tubular steel, 3/4" inch diameter, with end caps on open ends.
 - 1. Finish: Epoxy powder coat.
 - 2. Wall Thickness: 20 gage, 0.035 inch.
 - 3. Provide corner hanging rods and hanging rod connectors where required.
- C. Wall-Mounted Standards: Vertically slotted channel standards with double-tab cantilever brackets to suit shelving; factory finished to match shelving.
- D. Mounting Hardware: Provide manufacturer's standard mounting hardware; include support braces, wall brackets, back clips, end clips, poles, and other accessories as required for complete and secure installation; factory finished to match shelving.
 - 1. Provide intermediate support wall bracket for rod and shelf at any span 4' or more.
- E. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect areas to receive shelving, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.
- B. Verify appropriate fastening hardware.
- C. Do not begin installation until substrates have been properly prepared.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 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.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, with shelf surfaces level.
- B. Cap exposed ends of cut wires.
- C. Install back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer but in no case exceeding 48" between supports.
- D. Mounting Heights: See drawings.

3.04 CLEANING

- A. Clean soiled surfaces after installation.

3.05 PROTECTION

- A. Protect installed work from damage.
- B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

**SECTION 10 5736
CLOSET CURTAINS AND ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Closet Curtains
- B. Curtain Rods, Wall Cups, Center Support

1.02 WARRANTY

- A. Provide subcontractor warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURES

- A. Shaoxing Xiaoxuanchuang Household Fabric

2.02 CLOSET CURTAINS

- A. Two Layer Curtain:
 - 1. Size: 24" x 74"; 24" x 78"
 - 2. Fabric: GD2706 (Polyester)
 - 3. Color Light Brown
- B. Two Layer Curtain:
 - 1. Size: 36" x 74"; 36" x 78"
 - 2. Fabric: GD2706 (Polyester)
 - 3. Color Light Brown
- C. Two Layer Curtain:
 - 1. Size: 48" x 74"; 48" x 78"
 - 2. Fabric: GD2706 (Polyester)
 - 3. Color Light Brown
- D. Two Layer Curtain:
 - 1. Size: 60" x 74"; 60" x 78"
 - 2. Fabric: GD2706 (Polyester)
 - 3. Color Light Brown

2.03 CURTAIN RODS, WALL CUPS, CENTER SUPPORT

- A. Curtain Rod: D28mm Rod, Thickness: 300cm; Finish: Satin Nickel.
- B. Wall Cup: D28mm Wall Support; Finish: Satin Nickel.
- C. Center Support: D28mm Center Support; Finish: Satin Nickel.

END OF SECTION

**SECTION 11 3013
RESIDENTIAL APPLIANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Kitchen appliances.

1.02 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.
- B. Section 26 0583 - Wiring Connections: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

- A. UL (DIR) - Online Certifications Directory current listings at database.ul.com.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).
- C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Refrigerator: provide five (5) year manufacturer warranty on refrigerator compressor.
- C. Refrigerator: provide 1 year manufacturer warranty on balance of refrigerator.
- D. Rangehood: provide 1 year manufacturer warranty on rangehood.
- E. Microwave Oven: provide 1 year manufacturer warranty.
- F. Electric Range: 5 year limited manufacturer warranty on surface and 1 year manufacturer warranty on balance of appliance.
- G. Dishwasher: provide 1 year manufacturer warranty

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

- A. All Equipment Eligible for Energy Star Rating shall be Energy Star Rated.
- B. All ranges shall be provided with, and have installed an anti-tip bracket.
- C. Apartment Units: Shall receive one each as follows: (color shall be black on stainless)
 - 1. Standard Unit Range: Whirlpool 30" Free-Standing Electric Range with Self-Cleaning Oven, Model #: WFE550S0HB
 - a. Grease Shield: Baked on enamel finish over steel to match color of range or satin finished stainless steel with matching screws.
 - 2. Handicap Unit Range: Whirlpool 30" Slide-In Electric Range with Self-Cleaning Oven Model #: WEC310SAGB
 - a. Grease Shield: Baked on enamel finish over steel to match color of range or satin finished stainless steel with matching screws. #99406

3. Provide two (2) Stove Top brand "FireStop" (contractor to supply Owner with expiration dates per unit) automatic fire suppression canisters in each apartment, mounted on underside of range hood one over each side of range top.
 4. Range Hood: Whirlpool Range Hood Model #: UXT4030ADB, non-vented with charcoal filter and light.
 5. Unit Refrigerator all Units: "Whirlpool" Model No.: WRT134TFDB, energy star, 14 cubic foot, frost free. (ice maker deleted).
 6. Disposal: "Badger 1, 1/3 HP. Plug-in connection. Wire to wall switch.
 7. Dishwasher at standard units: "Whirlpool" Model#: WDF330PAHB, Energy Star, 24" built in.
 8. Dishwasher at HC units: Whirlpool Built-In Dishwasher; Model#: WDF550SAHB, Energy Star, 24" built in.
- D. Public Kitchen shall receive the following:
1. Whirlpool 25 cu. Ft. side by side refrigerator with dispenser, Estar Refrigerator in stainless steel model WRS325SDHZ
 2. Community Room Wall Oven, Micro Combo: Whirlpool, Model: WOC75EC0HS
 3. Dishwasher: Whirlpool model no. WDF550SAHS.
 4. Disposal: "Badger 5XP, 3/4 HP. Plug-in connection. Wire to wall switch.
- E. Exam Room shall receive the following:
1. Undercounter refridgerator: Summit Appliance, Model#: FF7LSSHVADA

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.04 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION

**SECTION 12 2113
HORIZONTAL LOUVER BLINDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Horizontal slat louver blinds.
- B. Operating hardware.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

- A. WCMA A100.1 - Safety of Corded Window Covering Products Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating physical and dimensional characteristics.
- C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Horizontal Louver Blinds Without Side Guides:
 - 1. SWFcontract, a division of Spring Window Fashions, LLC:
www.swfcontract.com/#sle.

2.02 BLINDS WITHOUT SIDE GUIDES

- A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.
- B. **Location: All living unit exterior windows. Including exterior doors with lites and side lites. All common area interior windows.**
- C. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.
- D. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand; complying with WCMA A100.1.
- E. Plastic Slats: PVC foam, radiused slat corners.
 - 1. Width: 1 inch.
 - 2. Texture: Smooth.
- F. Slat Support: Woven polypropylene cord, ladder configuration.
- G. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
- H. Bottom Rail: Pre-finished, formed steel; with end caps.
 - 1. Color: Same as headrail.
 - 2. **Location: doors with full lites or side lites i.e. patio doors. Confirm with architect.**

- I. Bottom Rail: Pre-finished, formed PVC with top side shaped to match slat curvature; with end caps. Color: Same as headrail.
- J. Control Wand: Extruded hollow plastic; hexagonal shape.
- K. Headrail Attachment: Wall brackets.

2.03 FABRICATION

- A. Determine sizes by field measurement.
- B. Fabricate blinds to fit within openings with uniform edge clearance of 1/4 inch.
- C. Fabricate blinds to cover window frames completely.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings are ready to receive the work.
- B. Ensure structural blocking and supports are correctly placed. See Section 06 1000.

3.02 INSTALLATION

- A. Install window treatments in accordance with manufacturer's instructions.
- B. Install window treatments level, plumb, square, and true. Allow proper clearances for window operation hardware.
- C. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
 - 1. Fascias.
 - 2. Closure panels.
 - 3. Endcaps.
- D. Secure in place with flush countersunk fasteners.
- E. Place intermediate supports per manufacturer's instructions.

3.03 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
- B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

- A. Adjust blinds for smooth operation.

3.05 CLEANING

- A. Clean blind surfaces just prior to occupancy.

3.06 TESTING AND DEMONSTRATION

- A. Demonstrate operation of shades to Owner's designated representatives.

END OF SECTION

**SECTION 12 3530
RESIDENTIAL CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Kitchen cabinets.
- B. Vanity cabinets.
- C. Casework hardware.

1.02 RELATED REQUIREMENTS

- A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

- A. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
- B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2016.
- C. KCMA A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets 2017.
- D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- E. KCMA (DIR) - Directory of Certified Cabinet Manufacturers Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, configurations, construction details, and joint details.
- C. Shop Drawings: Indicate casework locations, elevations, clearances required, rough-in and anchor placement dimensions and tolerances.
- D. Cabinet Finish Sample: Submit two samples of each type of finish, 2 inches by 3 inches in size, illustrating color, texture, gloss, and wood species.
- E. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Products: Complying with KCMA A161.1 and KCMA Certified.
- B. Manufacturer: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty.

PART 2 PRODUCTS

2.01 CABINETS

- A. Manufacturers:
 - 1. Substitutions: See Section 01 6000 - Product Requirements.
- B. Kitchen and Vanity Cabinets: Premanufactured and factory-finished, complying with construction and testing requirements in KCMA A161.1.
- C. Cabinet Box: Framed construction.
 - 1. Side Panels: Plywood.
 - 2. Face Frame: Solid wood.
 - 3. Interior Cabinet Finish: Thermally fused laminate.

- a. Color: to be selected by Architect...
- D. Cabinet Door/Drawer Configuration: Partial overlay.
- E. Cabinet Doors:
 - 1. Style: Brighton manufactured by SMART Cabinetry.
 - 2. Species: Maple.
 - 3. Color/Pattern: As indicated on the drawings.
- F. Cabinet Hardware: As selected from manufacturer's standard types, styles and finishes.
 - 1. Comply with BHMA A156.9.
 - 2. Drawer and Cabinet Pulls: Amerock Allison.
 - 3. Drawer and Cabinet Knobs: Amerock Allison.
 - 4. Hinges: Manufacturer's standard self-closing concealed hinges.
 - 5. Drawer Slides: Manufacturer's standard self-closing drawer slides.
- G. Countertops: As specified in Section 12 3600.

2.02 MATERIALS

- A. Adhesives Used for Assembly: Comply with VOC requirements for adhesives and sealants as specified in Section 01 6116.
- B. Wood-Based Materials:
 - 1. Certified as sustainably harvested as specified in Section 01 6000.
 - 2. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.
- C. Solid Wood: Clear, dry, sound, plain sawn, selected for species grain and color, no defects.
- D. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.
- E. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

2.03 MANUFACTURERS

- A. Residential Casework: Basis of design manufacturers listed below:
 - 1. Living Units: Smart Cabinetry, Brighton Maple; finish as selected.
 - 2. Common Areas: Smart Cabinetry, Brighton Maple; finish as selected.

2.04 COMPONENTS

- A. Cabinet Construction: Softwood lumber framing and particle board, tempered hardboard gables.
- B. Kitchen Countertop: Natural Stone as specified in Section 12 3600
- C. Vanity Countertop: Natural Stone as specified in Section 12 3600
- D. Door and Drawer Fronts: Solid wood.
- E. Bolts, Nuts, Washers and Screws: Of size and type to suit application.
- F. Concealed Joint Fasteners: Threaded steel.

2.05 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side/ back-mounted system using 1 inch spacing adjustments.
- C. Drawer and Door Pulls:

1. Product: Allison Value 3 inch(76mm) CTC pull; satin nickel. part no. BP69153G10 manufactured by Americok.
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish. At all common area cabinets.
- E. Drawer Slides:
 1. Type: Full extension.
 2. Static Load Capacity: Commercial grade.
 3. Mounting: Side mounted.
 4. Stops: Integral type.
- F. Hinges: European style concealed self-closing type, steel with satin finish.
- G. Pull out shelf: provide one manufactures pull out shelf in one base cabinet per dwelling unit.

2.06 FABRICATION

- A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- B. Fabricate corners and joints without gaps.
- C. Form smooth edges. Form material for countertops, shelves, and drain boards from continuous sheets.
- D. Provide cutouts for plumbing fixtures and appliances. Prime paint contact surfaces of cut edges.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.07 FINISHES

- A. Interior Surfaces: Plastic Laminate of manufacturer's standard color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of support framing.

3.02 INSTALLATION

- A. Install casework, components and accessories in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Carefully scribe casework abutting other components, with maximum gaps of .0125 inch [] inch.
- E. Close ends of units, back splashes, shelves and bases.

3.03 ADJUSTING

- A. Adjust doors, drawers, hardware, and other moving or operating parts to function smoothly.

3.04 CLEANING

- A. Clean casework, countertops, shelves, and hardware.

3.05 PROTECTION

- A. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

SECTION 12 3600 COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Countertops for manufactured casework.
- C. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

- A. Section 12 3530 - Residential Casework.
- B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

- A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.
- B. ANSI A208.1 - American National Standard for Particleboard 2016.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).
- E. PS 1 - Structural Plywood 2009 (Revised 2019).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.
- B. Installer Qualifications: Fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Natural Stone Countertops: Stone slabs bonded to substrate; use as large pieces as possible with inconspicuous adhesive joints.
 - 1. Stone: Granite without cracks, voids, or pin holes ; filling with matching epoxy resin is acceptable.
 - 2. Color: Level 2 as selected by the architect.
 - 3. Stone Thickness: 1 inch, minimum.
 - 4. Surface Finish: Polished.
 - 5. Exposed Edge Treatment: Square profile stone, 1 inch thick, with 1/2 inch radius corner.
 - 6. Back and End Splashes: Same material, same thickness; for field attachment.
 - 7. See drawings.

2.02 MATERIALS

- A. Wood-Based Components:
 - 1. Wood fabricated from old growth timber is not permitted.
- B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- E. Joint Sealant: Mildew-resistant silicone sealant, color as selected by Architect clear.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
 - 4. Provide radiused outside corners.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches standard. Provide 6" height at accessible units and public use common areas unless otherwise indicated.
- C. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Field Measurements: Verify countertop size and shape prior to fabrication by field measurements taken after base units are installed.

- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 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.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 12 4813
ENTRANCE FLOOR MATS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet mat.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Samples: Submit two samples, [] by [] inch in size illustrating pattern, color, finish, and edging.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Floor Mats:
 - 1. American Floor Products Company, Inc; []: www.afco-usa.com/#sle.
 - 2. R.C. Musson Rubber Co; []: www.mussonrubber.com/#sle.
 - 3. Pawling Corporation; []: www.pawling.com/#sle.

2.02 MATS

- A. Carpet Mat: Cut nylon pile permanently bonded to vinyl backing; [] inch wide by [] inch long with one inch black matching vinyl border on all edges.

PART 3 EXECUTION

3.01 PREPARATION

- A. Mats: Verify size of floor recess before fabricating mats.
- B. Vacuum clean floor recess.

3.02 INSTALLATION

- A. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

END OF SECTION

**SECTION 14 2819
ELEVATOR EQUIPMENT**

PART 2 PRODUCTS

1.01 ELEVATOR EQUIPMENT

- A. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring and Devices, and Indicators: Comply with NFPA 70.
- B. Guide Rails, Cables, Counterweights, Sheaves, Buffers, Attachment Brackets and Anchors: Purpose designed, sized according to code with safety factors.
- C. Buffers: Spring type.
- D. Lubrication Equipment:
 - 1. Provide grease fittings for lubricating bearings requiring periodic lubrication.
 - 2. Grease Cups: Automatic feed type.
 - 3. Lubrication Points: Visible and easily accessible.

1.02 MANUFACTURERS

1.03

- A. Dover
- B. ThyssenKrupp
- C. Schindler
- D. Canton
- E. Mowrey
- F. Kone

1.04 EQUIPMENT TYPE: 2 GEARLESS (TRACTION); SPEED: TO MATCH EXISTING; 13 STOPS (13 FRONT /0 REAR); CAPACITY: TO MATCH EXISTING

- A. Description of Work
 - 1. Controller
 - a. Controller (Includes Options Listed Below)
 - 1) 24 VDC Signal Voltage
 - 2) Auto Light and Fan Feature
 - 3) Car Independent Service
 - 4) Car Traveling Lantern Circuitry
 - 5) Door Bypass Operation
 - 6) Electronic Door Detector Interface
 - 7) Hoistway Access and Enable
 - b. Green Drive
 - c. Emergency Power
 - d. Machine Room Wiring Package
 - e. Monitoring Device Provisions
 - 2. Machine
 - a. Hoist Cables, Traction Steel, Preformed
 - b. Machine Room Interface Box for Machines by Field (Choke & Encoder Interface)
 - c. Hang Car
 - d. New Machine
 - 3. Car
 - a. Toe Guard for 2000 Code (48")
 - b. Car Top Railing
 - c. Cable Strain Loadweigher (for 4 Ropes/7 Ropes)
 - d. Car Top Inspection Station (Stand Alone)

- e. Fan: Two Speed
- 4. Hoistway
 - a. Wiring Package:
 - 1) Includes Single Flat Traveling Cable with Coax
 - 2) Hoistway Wiring
 - 3) Interlock Wiring
 - 4) Interlock Connectors
 - 5) Serial Wiring
 - 6) FIBER OPTIC CABLE, HOISTWAY PIPING & DUCT ARE NOT INCLUDED
 - b. APS (Absolute Positioning System) for TAC32T
 - c. Final Limit Switches, Brackets, & Cams (For TAC32T)
 - d. Alarm Bell (for Hoistway)
- 5. Pit
 - a. Pit Stop Switch
 - b. Pit Ladder 16" Wide
- 6. Cab
 - a. Car Door (SSSS, #4 S/S (441))
- 7. Door Equipment
 - a. Door Operator with Complete Carside Equipment (FRONT)
 - 1) Includes Adapter kit (Tracks & Hangars), Clutch (w/ Car Door Lock Latch & Contact), & Car Top Inspection Station (w/Alarm Signal)
 - b. Micro Light (Front)
 - c. Interlock / Pick Up Assemblies for Existing Dover Operators. Includes Closers
- 8. Car Fixtures
 - a. Main Car Station Includes Options Below
 - 1) Applied Panel
 - b. Panel Screws
 - c. Cast Braille Plates for Car Features
 - d. Standard Key Switch Package
 - 1) Fan
 - 2) Light
 - 3) Independent
 - 4) Stop
 - 5) Inspection (Hoistway Enable)
 - e. Emergency Light Mounted in COP
 - f. 2004 and Later Fire Service Phase II Features (Includes Instructions Signage)
 - g. Handicap Signal (Passing Signal)
 - h. Position Indicator (2" CE Segmented)
 - i. ADA Phone System Integral with COP (Rath)
 - j. Speaker Pattern for Intercom System/ADA Phone
 - k. No Smoking Symbol (Cast)
 - l. Locked Service Cabinet
 - m. Certificate Window
 - n. Default Engravings
 - o. #4 Stainless Steel Finish (441)
 - p. TAC Serial Boards (Main)
- 9. Hall Fixtures
 - a. Serial Boards for Hall Lanterns/PI's
 - b. Serial Boards for Hoistway Access
- 10. For Both Elevators
 - a. Serial Boards for Front Risers

- b. TAC Serial Boards, Base Charge
- c. Fire Service Key Switch (2 Position)
 - 1) Emergency Power Keyswitches (Up to 2 Elevators)
- d. Digital Position Indicators
 - 1) Operating Status Indicators (In Service Jewels)
 - 2) Emergency Power Jewel
 - 3) Lobby Recall Switch
- e. Lobby Signal Fixture
 - 1) Serial Configuration
 - 2) Space for Intercom (Speaker Pattern)
 - 3) #4 Stainless Steel Finish

END OF SECTION

SECTION 22 00 10
DOCUMENT INTERPRETATION AND GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section. Contractors and Subcontractors shall examine Architectural, Structural, Electrical and all other Drawings and Specifications pertinent to this project. The above mentioned Drawings and Specifications for all the Divisions are part of the Contract Documents.

1.02 SCOPE

- A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in sections of Division 1.
- B. Drawings and Specifications are to be considered as supplementing each other. Work specified but not shown, or shown but not specified, shall be performed or furnished as though mentioned in both Specifications and Drawings.
- C. This section describes the requirements for demolition of plumbing equipment, materials, and systems and defines equipment and material salvage rights.
- D. This Section specifies requirements of Codes and Standards to which this project must conform.

1.03 INFERRED PHRASES

- A. Where the words "submit", "submitted", "approval", or "approved" or similar are used without an object of the verb, the phrase shall be assumed to read: "Submit to the Architect", "Submitted to the Architect", or "Approved by the Architect" as appropriate, unless otherwise noted.

1.04 PERMITS

- A. Unless noted otherwise, this Contractor shall secure and pay for all permits and certificates of inspection required for the work under this Division.
- B. Deliver all certificates and official records of approval, by governing agencies, to the Architect.

1.05 CODES

- A. Reference to the codes and standards listed shall constitute the minimum acceptable requirements. Nothing in the Specifications shall be construed to permit deviation from the requirements of the governing code. Where requirements of the Drawings and Specifications exceed those of the code listed, follow the Drawings and Specifications.
- B. The scope of work shall include the furnishing of systems, equipment and materials specified in this division and as called for on the Drawings. Work shall include supervision, operations, methods and labor for the fabrication, installation, start-up and tests for the complete installation.
- C. Install work in full accordance with rules and regulations of State, County and City authorities having jurisdiction over premises. This shall include safety requirements of the State of Ohio Division of Industrial Relations and OSHA.
- D. All wiring shall be in compliance with the current edition of the National Electric Code, Applicable State Code, Applicable local (city) Code and OSHA. In cases of conflict between code and specifications, the more restrictive requirements shall govern.
- E. All equipment, materials and installation methods shall comply with the following, where applicable:
 - 1. Building Officials and Code Administrators International (BOCA)

2. Codes and Standards Association (CSA)
3. International Building Code (IBC)
4. International Mechanical Code (IMC)
5. National Building Code of Canada (NBC)
6. National Electric Code (NEC)
7. National Fire Protection Association (NFPA)
8. National Pressure Vessel Code
9. Ohio Building Code (OBC)
10. Ohio Plumbing Code (OPC)
11. International Association of Plumbing and Mechanical Officials (IAPMO)

1.06 STANDARDS

- A. All equipment, materials and installation methods shall comply with the following, where applicable.
 1. Air Conditioning and Refrigeration Institute (ARI)
 2. Air Conditioning, Heating, Refrigeration Institute (AHRI)
 3. American National Standards Institute (ANSI)
 4. American Society for Testing and Materials (ASTM)
 5. American Society of Mechanical Engineers (ASME)
 6. American Society of Sanitary Engineering (ASSE)
 7. American Water Works Association (AWWA)
 8. American Welding Society (AWS)
 9. Cast Iron Soil Pipe Institute (CISPI)
 10. Fluid Sealing Association (FSA)
 11. National Institute of Standards and Technology (NIST)
 12. National Pressure Vessel Code
 13. National Sanitation Foundation (NSF)
 14. National Science Foundation (NSF)
 15. Plastic Pipe Institute (PPI)
 16. Underwriter's Laboratories of Canada (ULC)
 17. Underwriters Laboratories, Inc. (UL)

1.07 DESIGN DRAWINGS

- A. The Contract Drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment and piping unless dimensions are given. Equipment and piping are to be installed along the general plans shown on the Drawings, but keeping in mind actual building conditions.

- B. Because of the scale of the drawings, certain basic items may not be shown, but where such items are required by other Sections of these specifications or where they are required by the nature of the work, they shall be furnished and installed. Rough-in dimensions and locations shall be verified with the supplier of all equipment furnished by other trades or by the Owner prior to the time of roughing-in.
- C. All equipment, piping and material specified hereinafter as shown on the Drawings shall be furnished and installed by this Contractor, unless specifically indicated to the contrary.
- D. If this Contractor proposes to install equipment requiring space conditions other than those as specified and/or shown on the Contract Drawings, or to rearrange the equipment, he shall assume full responsibility and expense for the rearrangement of the space and shall obtain the full approval of the Architect before proceeding with the work.
- E. This Contractor shall locate all equipment that must be serviced, operated or maintained in fully accessible positions. Minor deviations from the Contract Drawings may be made to allow for better accessibility, but changes of magnitude, or which involve extra cost, shall not be made without approval. Ample space shall be allowed for removal of all parts that may require replacement or service in the future.
- F. The Drawings and the Specifications are cooperative and supplementary. It is the intent of both said Drawings and Specifications to cover all plumbing requirements in their entirety as nearly as possible. This Contractor shall closely check the Drawings and Specifications for any obvious errors or omissions, and bring any such condition to the attention of the Architect prior to the receipt of bids, in order to permit clarification by means of an Addendum. If there is no question prior to the bid proposal date, the Architect shall assume that the Drawings and Specifications are complete and correct and will expect the intent of said documents to be complied with, and the installation to be complete in all respects according to said intent.
- G. This Contractor shall have a complete set of drawings including Architectural, Structural, Mechanical and Electrical drawings on the site at all times. Prior to installing any of his work, this Contractor shall check the drawings for exact dimensions and see that his work does not interfere with clearance required for beams, foundations, finished columns, pilasters, conduits, partitions, piping, ductwork, etc., as shown on the drawings and details. After work is installed, if interferences develop that have not been called to the attention of the Architect before the installation, this Contractor shall, at his own expense, make such changes in his work as directed by the Architect.
- H. Extra costs which might result from deviations from the Drawings, so as to avoid interferences, shall be considered a "Job Condition", and no additional compensation will be considered applicable. In the event that such interferences occur in the course of the Work, due to an error, omission, or oversight by the Contractor, no additional compensation shall be allowed. Interferences which may occur during the course of construction shall be brought to the immediate attention of the Architect, and his/her decision, confirmed in writing, shall be final.

1.08 EXAMINATION OF SITE

- A. Before submitting a bid, it is recommended that each Contractor visit the site and become familiar with conditions affecting this work. No additional payment will be made on claims that arise from lack of knowledge of existing conditions.

1.09 BASIS OF DESIGN

- A. Where more than one manufacturer is listed in the Specifications as being acceptable, it shall be understood that the "basis of design" manufacturer is the manufacturer included in the equipment schedule or with the model number listed. Subject to project requirements, all other listed manufacturers are considered as acceptable alternatives. If installation of an acceptable alternative alters the design, electrical or space requirements indicated on the Drawings, this Contractor shall bear the costs for the revised design and construction including costs of all trades involved.

1.10 EQUIPMENT AND MATERIALS

- A. Prior to the signing of the Contract, the successful bidder may be required to submit to the Architect a list of manufacturers of the major items of equipment he proposes to furnish and the names of any subcontractors he proposes to employ.
- B. When two or more items of same equipment type are required (plumbing fixtures, valves, etc.) they shall be of the same manufacturer.
- C. All equipment and materials shall be new.
- D. Provide material and labor which is neither drawn nor specified but which is obviously a component part of and necessary to complete work and which is customarily a part of work of similar character.

1.11 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in the manufacture of equipment, of types and sizes required whose products have been in satisfactory use in similar service for not less than 3 years.

1.12 COORDINATION AND SUPERVISION

- A. This Contractor shall examine the work of other trades and shall so coordinate and schedule work as not to cause delays or interference with work of others.
- B. Determine sizes and locations of structural openings necessary for the installation of plumbing systems. Coordinate these openings and the setting of sleeves with other trades, to accomplish the installation of fixtures, equipment and piping with minimal cutting through concrete or masonry.
- C. Coordinate the installation of all required supporting devices, inserts and hangers in structural components as they are constructed.
- D. Install plumbing equipment and components (valves, etc.) to facilitate servicing, maintenance and repair or replacement. Coordinate the final location of concealed equipment and components requiring access with the final location of access doors and panels. Allow adequate space for proper servicing, maintenance and repair. Make final connections to equipment with consideration for future disconnection and removal with minimal interference with other installations.
- E. Where installation is to occur in an area with no ceiling and mounting heights are not detailed or dimensioned on the Drawings, install equipment components and systems to provide maximum possible headroom.
- F. Install additional piping offsets as required to obtain maximum headroom or to avoid conflicts with other work, without additional cost to the Owner.
- G. Before installing work, report any interferences between work of this Division and work of other Divisions to the Architect as soon as they are discovered. The Architect shall determine which work must be relocated, or make adjustments to maintain clearances and required headroom and to avoid conflict with other work. If any work is installed so that the Architectural design cannot be adhered to, this Contractor is liable for cost of making such changes as the Architect may require.
- H. Ceiling grid systems shall not be supported from equipment or piping and vice versa. Where interferences occur, in order to support piping, ceiling grid systems, etc., trapeze type hangers or supports shall be employed which shall be located so as not to interfere with access to plumbing equipment such as valves, etc.
- I. Provide adequate competent supervision at all times when work is being performed. Cooperate with all other trades to avoid interferences and delays.

1.13 PROTECTION OF WORK AND PROPERTY

- A. The Contractor shall be responsible for safeguarding work, property and facilities against damage, both his own as well as others, with which he may come into contact in the performance of his work.
- B. Stored materials shall be protected against damage from weather. Pipe openings shall be closed with caps or plugs during installation. All fixtures and equipment shall be covered and protected from damage. Any materials or equipment damaged at any stage in the construction shall be replaced or repaired and shall be in a clean, unblemished condition at project turnover.
- C. Protect floors and walls against staining and abrasion from chips and cutting oil where pipe cutting and threading machines are used.
- D. Protect equipment and finished surfaces from soldering and brazing with baffles and blankets.
- E. Use drop cloths to protect finished surfaces from paint and insulation adhesive droppings.

1.14 DELIVERY, STORAGE AND HANDLING

- A. This Contractor shall pay all costs for the transportation of materials and equipment, included in this contract, to the job site.
- B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification.
- C. Each Contractor shall make provisions for the delivery and safe storage of his materials and equipment in coordination with the work of others. Materials and equipment shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.

1.15 CLEAN-UP

- A. Refer to Division 1 for general requirements for final cleaning.
- B. Insofar as this Division is concerned, at all times keep premises and building in a neat and orderly condition follow explicitly any instructions of the Architect in regard to storing of materials, protective measures, cleaning-up of debris, etc.
- C. Upon completion of work remove all tools, equipment, surplus materials, etc. from the project site.
- D. Prior to project turn-over thoroughly clean all piping, fixtures, and equipment, removing all dirt, grease, oil and dust. It is recommended that steps are taken to eliminate this dust buildup during construction.

1.16 DAMAGE AND EMERGENCY REPAIRS

- A. Assume responsibility for any damage caused by leaks in the piping system being installed or reworked under this Contract. Repair all damage without extra cost to the Owner. Restore building, piping, insulation etc. to their original condition.
- B. The Owner reserves the right to make emergency repairs as required to keep equipment in operation, without voiding Contractor's guarantee or relieving him of responsibility during warranty period.

1.17 WARRANTIES

- A. This Contractor shall warrant for a period of one year (from the date of final acceptance) that all work and equipment will remain free from all defects in workmanship and materials, and that it will comply with all the specific requirements of the Specifications and other Contract Documents governing the work.
- B. All work found by the Architect to be defective will be replaced with new work meeting all the requirements of the Contract. This Contractor will bear all costs of supplying such new work, and installing and finishing same, and will assume all costs for replacing other work damaged by the removal and replacement of any of the work.

- C. Include copies of all warranties in the operation and maintenance manuals.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Examine areas and conditions where equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install equipment as indicated, and in accordance with manufacturer's installation instructions. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- C. Locate equipment, plumb and level, firmly anchored in locations indicated. Coordinate with other trades to assure correct recess size for recessed units. Hang ceiling units from building substrate, not from piping. Support units with rod-type hangers anchored to building substrate.
- D. All equipment shall be installed with adequate clearance provided for routine maintenance and servicing. Locate horizontal, above-ceiling units to maintain access with ceiling components below.

3.02 ELECTRICAL WIRING

- A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electric Installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.03 DEMOLITION WORK - SERVICES

- A. Active Services: When encountered, support active plumbing services as necessary. If active services require relocation (other than those indicated on the drawings), obtain written instructions before proceeding. Do not disturb active services scheduled to remain.
- B. Inactive or Abandoned Services: When encountered, remove inactive and abandoned piping full length. Removal shall include all hangers and supports. Notify servicing utility when encountered outside of structure. "Dead Legs" shall not be left in any piping system.
- C. Interruption of Service: See "Plumbing Systems Shut-downs" section in these specifications for procedures and requirements.

3.04 DEMOLITION WORK – GENERAL

- A. Remove equipment, materials, and systems as indicated on the drawings and per this section.
- B. Remove all existing fixtures, piping, controls, wiring and equipment as indicated on the drawings or those that are not necessary to maintain service to equipment and devices that are to remain.
- C. Relocate or extend as required, piping that interferes with demolition and is essential to maintain service to equipment and fixtures that are to remain.
- D. Remove or relocate all equipment and fixtures specifically indicated on the drawings and as required to complete demolition work.
- E. In those cases where equipment and fixtures are removed, the associated piping that will no longer be active shall be removed.
- F. All piping to be removed shall be removed full length back to the source or an active line or portion of the system.
- G. All holes or damage caused by the removal of existing equipment, fixtures, and piping shall be properly patched. Holes shall be neatly patched with suitable materials to match existing surfaces.

- H. Piping that is indicated to be removed and penetrates the ground floor slab shall be removed to within six (6) inches of the top of floor slab, and capped.
- I. Piping that is indicated to be removed and penetrates the basement exterior wall and continues outside the building below grade shall be cut within six (6) inches of the inside surface of the exterior wall and capped.

3.05 SAFE DISPOSAL OF HAZARDOUS MATERIALS

- A. Contractor shall safely dispose of all hazardous materials encountered in full compliance with all Federal and State EPA regulations.
- B. Contractor shall identify installed facilities requiring removal or modification that are suspected to contain asbestos insulation. If suspicious insulation is encountered, the Contractor will cease demolition or modifications and shall notify the Owner.
- C. The Contractor shall not be responsible for removal of asbestos insulation.
- D. The Contractor shall work with the owner's asbestos removal and abatement contractor to prioritize abatement work and develop a schedule for removal of hazardous materials so as not to affect the mechanical contractual timeframe.

3.06 SALVAGE

- A. Plumbing fixtures, equipment, piping and devices that are to be removed shall be offered to the Owner for salvage. Fixtures, equipment, piping and devices selected shall be stored on the site at areas designated by the Owner.
- B. All items not selected for salvage by the owner shall become the property of the Plumbing Contractor and shall be removed from the site by the Plumbing Contractor.

3.07 SYSTEM SHUT-DOWNS

- A. This Section specifies the basic requirements and procedures for shutting down existing, active Plumbing systems and includes requirements for temporarily services should a system need back-fed during an unavoidable shut-down or need to remain operational at all times. Temporary services portion of this section supplements and expands on the requirements of Division 1.
- B. General
 - 1. The Contractor shall work with the Owner to schedule and plan required system shutdowns. The Contractor shall identify all necessary shutdowns and shall identify the approximate date(s) shutdowns will be required at the outset of the project.
 - 2. The Owner shall reserve the right to dictate final time and date of all shutdowns. The Contractor shall perform all shutdowns at the time and date as directed by the Owner, even if they are required to be performed on weekends or after normal business hours.
 - 3. The Contractor shall work with the Owner's personnel to identify isolation valves in the existing systems requiring shut-down to properly isolate active portions of the system from the targeted inactive portion of the system. Should isolation valves not be present, or not be functional, the Owner shall be notified of the deficiency. In any case, the shut-down shall still be required and deficiencies of the existing system shall be planned around.
- C. Sewer System
 - 1. The Contractor shall identify all fixtures and equipment serviced by the portion of the building's sewer system upstream of the targeted work area.
 - 2. The Contractor shall identify the approximate amount of time required to perform the work which required that the system be taken out of service.

3. The Contractor shall work with the Owner to identify the optimum time and date that the previously identified fixtures and equipment can be taken out of service for the previously identified period of time.
 4. The Contractor shall perform the necessary work to the existing sewer system at the previously agreed upon date and time. The Contractor shall follow common piping practices or those as identified in other sections of this division to perform said work.
- D. Storm System
1. The Contractor shall identify all roof drains, area drains, or equipment serviced by the portion of the building's storm water system upstream of the targeted work area.
 2. The Contractor shall identify the approximate amount of time required to perform the work which required that the system be taken out of service.
 3. The Contractor shall work with the Owner to identify the optimum time and date that the previously identified fixtures and equipment can be taken out of service for the previously identified period of time.
 4. The Contractor shall perform the necessary work to the existing storm water system at the previously agreed upon date and time. The Contractor shall follow common piping practices or those as identified in other sections of this division to perform said work.
- E. Domestic Cold Water System
1. The Contractor shall isolate the portion of the system where tie-ins or demolition work is to be performed from other portions of the system by existing isolation valves. If existing isolation valves are not present and new isolation valves are not indicated, the Engineer shall be notified.
 2. The Contractor shall identify all fixtures and equipment serviced by the portion of the building's domestic cold water system downstream of the targeted work area and downstream of the previously identified isolation valve, if any are present.
 3. The Contractor shall identify the approximate amount of time required to perform the work which required that the system be taken out of service.
 4. The Contractor shall work with the Owner to identify the optimum time and date that the previously identified fixtures and equipment can be taken out of service for the previously identified period of time.
 5. The Contractor shall perform the necessary work to the existing domestic cold water system at the previously agreed upon date and time. The Contractor shall follow common piping practices or those as identified in other sections of this division to perform said work.
- F. Domestic Hot Water System
1. The Contractor shall isolate the portion of the system where tie-ins or demolition work is to be performed from other portions of the system by existing isolation valves. If existing isolation valves are not present and new isolation valves are not indicated, the Engineer shall be notified.
 2. The Contractor shall identify all fixtures and equipment serviced by the portion of the building's domestic hot water system downstream of the targeted work area and downstream of the previously identified isolation valve, if any are present.
 3. The Contractor shall identify the approximate amount of time required to perform the work which required that the system be taken out of service.

4. The Contractor shall work with the Owner to identify the optimum time and date that the previously identified fixtures and equipment can be taken out of service for the previously identified period of time.
5. The Contractor shall perform the necessary work to the existing domestic hot water system at the previously agreed upon date and time. The Contractor shall follow common piping practices or those as identified in other sections of this division to perform said work.

3.08 DAMAGE AND EMERGENCY REPAIRS

- A. Assume responsibility for any damage caused by leaks in the piping system being reworked under this Contract. Repair all damage without extra cost to Owner. Restore building, piping, insulation etc. to their original condition.
- B. Owner reserves the right to make emergency repairs as required to keep equipment in operation, without voiding Contractor's guarantee or relieving him of responsibility during warranty period.

3.09 TEMPORARY SYSTEM BACK-FEED

- A. When Required:
 1. Amount of work necessitating a system be shutdown require it to be taken out of service for a period of time greater than is allowed by the building owner
 2. A time and date are not be available that fits within the project construction schedule and the owner's use of said system
- B. The Contractor shall arrange for temporary service of the system in question to provide the necessary utility for the building's use while the permanent system is deactivated to perform required work.
- C. The cost of any equipment rental, temporary equipment power, hook-up of temporary equipment into the permanent system, etc., required to keep service of a utility to the building's occupants shall be considered a project requirement and shall not be considered additional services which would warrant a change order.

3.10 ADJUSTING AND CLEANING

- A. General: After construction is complete, including painting, clean all equipment exposed surfaces.
- B. Retouch any marred or scratched surfaces of factory-finish, using finish materials furnished by the manufacturer.

END OF SECTION 22 00 10

**SECTION 22 01 10
PROJECT SUBMITTAL REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section contains:
 - 1. General requirements and procedures for Submittals and Shop Drawings.
 - 2. Requirements for Operation and Maintenance Manuals (O&M manuals) for all Division 22 work.
 - 3. Requirements for record drawings for documentation of installed conditions for all Division 22 work.
- B. For specific requirements, see individual specification sections.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Where applicable, the Contractor shall submit:
 - 1. Shop Drawings
 - 2. Operation and Maintenance Manuals
 - 3. Piping System Integrity Test Reports
 - 4. Start-up Reports
 - 5. Record Drawings
 - 6. Factory Tests
- B. A list of required submittals are specified in each individual specification section.

3.02 SUBMITTAL PROCEDURES

- A. Shop drawings
 - 1. Contractor Review
 - a. This Contractor shall review, stamp and sign with approval all submittals and deliver with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other Contractor.
 - b. Submission of shop drawings without review, signature, and approval shall be cause for rejection. Such submittals shall be returned without review.
 - c. If the submittal includes deviations from the requirements of the Contract Documents, the Contractor shall clearly note the deviations "in red" on the submittal.
 - 2. Electronic Submission
 - a. All submittals shall be in electronic format. Electronic submittals shall conform to this specification.
 - b. Electronic submittals shall conform to the following requirements:
 - 1). Electronic submittals shall be in Portable Document Format (.pdf)

- a). Electronic submittals shall include a transmittal.
 - b). All portions of the electronic submittal shall be bound in a single .pdf file.
 - c). File shall be named to match submittal name as it appears on the individual specification.
 - i. Example: "22 17 30 - Strainers".
 - d). Submittals shall specifically identify any deviations from the Contract Documents.
 - 2). Electronic submittals shall include a Contractor review stamp that indicates review and approval by the Contractor prior to submission.
 - 3). Electronic submittals shall be transmitted via an e-mail:
 - a). Provide only one submittal per e-mail
 - b). E-mail subject line shall clearly indicate:
 - i. Project name
 - ii. That the e-mail contains a submittal
 - iii. Contents of submittal
 - c). Failure to conform the requirements above may result in rejection.
 - d). At the Reviewer's discretion, the Reviewer has the option to return the submittals in whatever method is most convenient or appropriate for the Project.
3. Shop Drawing Cover Form
 - a). All submittals shall include a Cover form.
 - b). Follow the Architects requirements for the cover form.
 - c). Cover form shall contain, at a minimum, the following information:
 - 1). Submitting Contractors Contact information
 - 2). Shop Drawing Number and Name (As noted in Project Submittal Requirements)
 - 3). Issue (Original, Resubmittal 1, etc.)
 - 4). Name of equipment manufacturer
 - 5). Name of equipment supplier
 - d). If the submittal includes deviations from the requirements of the Contract Documents, the Contractor shall clearly indicate such deviations on the shop drawings cover form.
4. Engineer's Review
 - a). Shop drawings shall be reviewed only for general compliance and not for dimensions or quantities. The Reviewer will make reasonable efforts to detect and correct errors, omissions and inaccuracies but shall not be responsible for failure to detect errors, omissions, or inaccuracies. Failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.

- b. The Engineer shall mark the shop drawings in one of the ways outlined below. See each description for interpretation of Engineers marks and Contractor responsibilities associated with each.
 - 1). APPROVED: The submittal complies with the requirements of the specifications.
 - 2). APPROVED AS NOTED: The submittal generally complies with the requirements of the specifications but some non-critical items which need to be corrected/coordinated are noted. The corrections shall be changed on the shop drawings submitted for inclusion in the Operations and Maintenance Manual. Re-submittal is not required unless noted otherwise.
 - 3). REVISE AND RESUBMIT: The submittal generally complies with the requirements of the specifications but some critical items which need to be corrected/coordinated are noted. The submittal must be revised and resubmitted with all comments addressed.
 - 4). REJECTED: The submittal does not comply with the requirements of the specifications. The submittal must be revised and resubmitted.
 - c. Approval of submittal items shall not eliminate the Engineers right to reject those items if defects are discovered prior to final acceptance of the completed work.
- B. Operations and Maintenance Manual
 - 1. Submit one (1) copy of the Division 22 manual to the Architect/Engineer for review.
 - 2. After review, address Architect/Engineer's comments and provide the Owner with three (3) hardbound copies of the final approved operating and maintenance manuals for Division 22. Obtain receipt. Note – Operation and Maintenance manuals are required before Owner training takes place.
 - C. Record Drawings
 - 1. Submit a complete set of red-lined drawings indicating "as-installed" locations of piping, ductwork, and equipment.

3.03 SHOP DRAWING CONTENT

- A. Indicate specific options or accessories on shop drawings by pointing to, checking off, or underlining. Do not use highlighter.
- B. Do not reproduce Contract Documents or copy standard information as the basis of shop drawings. Standard information prepared without specific reference to the Project is not considered shop drawings and will be cause for rejection.
- C. Shop Drawings shall contain the following information, where applicable.
 - 1. General:
 - a. Model Number
 - b. Dimensions
 - c. Weight
 - d. Clearance requirements
 - e. Special rigging requirements
 - f. Material
 - g. Color and finish
 - h. Installation recommendations

- i. Ratings
- j. All included options and accessories
- 2. Performance:
 - a. Performance data as scheduled and/or specified (at a minimum)
 - b. Code/standard compliance information
 - c. Pressure drop curve or chart
- 3. Connections:
 - a. All pipe and duct connections, including:
 - 1). Size(s)
 - 2). Location(s)
 - 3). Connection service (Supply, return, exhaust, etc.)
 - 4). Connection method
 - b. Electrical connections:
 - 1). Location(s)
 - 2). Termination lug size(s)
 - 3). Plug NEMA configuration
- 4. Electrical:
 - a. Characteristics, including:
 - 1). Voltage/Phase
 - 2). Full load and locked rotor amps
 - 3). Required overcurrent protection and short circuit interrupting capacity
 - 4). Horsepower of motor(s)
 - b. Power wiring diagram
 - c. Accessories furnished, including starter(s), disconnect(s), on/off switches, etc.
 - 1). Clearly indicate if accessories are factory or field mounted/wired.
- 5. Controls:
 - a. Wiring terminations for required interlock and control wiring
 - b. Wiring diagram, with factory installed and field installed portions clearly differentiated.
 - c. Accessories furnished, including thermostat(s), sensor(s), etc.
 - 1). Clearly indicate if accessories are factory or field mounted/wired.
 - d. Sequences of operation
 - e. Integration
 - 1). Protocol(s), including baud rate.
 - 2). Available points, with read/write capabilities clearly noted.
 - 3). Registers required for integration.
- 6. Refer to individual specifications sections for special required information.

3.04 OPERATOR AND MAINTENACE MANUAL FORMAT

- A. Binder:
 - 1. Include all materials in a three (3) ring binder or binders, if volume of content dictates multiple books.
 - 2. Provide a type-written cover for the binder indicating project title, contractor firm name and address, date of substantial completion (project finish date), and owner company name.
- B. Index:
 - 1. Include a numbered index indicating ALL documents included in the manual.
- C. References:
 - 1. Include a page or pages indicating contractor firm name, address, and contact phone number.
 - 2. Indicate the contractor's job foreman, including contact phone number and email address.
 - 3. Indicate all subcontractors utilized, including contact phone numbers and email addresses for each.
 - 4. Name of service agency and installer. Include 24 hour per day emergency phone numbers.
 - 5. Include design Architect reference, including contact phone numbers.
 - 6. Include design Engineer reference.
- D. Contents:
 - 1. Provide a separate tabbed section for each specified item type including the following, if applicable:
 - a. Identification, name, mark, or number as indicated on the design drawings.
 - b. Final accepted shop drawing, including Engineer's cover form indicating "Accepted" without exception.
 - c. Manufacturer's maintenance and service manuals including instructions for troubleshooting, disassembly, repair, reassembly, adjusting, aligning, servicing and lubrication.
 - d. Spare/replacement parts list.
 - e. Belt sizes, type and lengths (where applicable).
 - f. Step by step procedures for startup and shutdown of each system and piece of equipment.
 - g. Copy of equipment start-up report and/or capacity test (if required as part of equipment specification). See Equipment and System Start-up specification section for requirements.
 - h. Equipment manufacturer's warranty.
 - 2. Automatic controls including device schedules, diagrams and written sequence of operations.
 - 3. Final accepted balance reports as required by this specification.
 - 4. Copy of all system integrity verification report, where required. See Piping Systems Flushing and Testing specification section for requirements.
 - 5. Copy of all piping system flushing, cleaning, and certification reports as required by this Specification.

6. Copy of testing, adjusting, and balancing report as required by this division specification.
 7. Copy of Ductwork leakage testing report as required by this division specification.
- E. Warranties
1. Contractor warranty including date of final acceptance (this indicates the start of the warranty period).
 2. Date of final acceptance shall be issued by the Architect.
- F. Electronic Requirements
1. Provide Operations and Maintenance Manuals to Owner and Engineer in .pdf format.

3.05 RECORD DRAWINGS

- A. Field Documentation
1. This Contractor shall record all changes from original design drawings made during installation. These changes shall be recorded in red ink on a dedicated copy of the final approved construction or coordination drawings. Changes shall be accurately dimensioned and/or drawn to scale.
 2. This Contractor shall keep an updated set of prints, including changes, on the job site at all times and shall submit one (1) set of updated and legible "as-built" prints to the Architect when the work is complete.
 3. Prepare record documents in accordance with the requirements in Division 1.
 4. In addition to the requirements specified in Division 1, indicate the following installed conditions.
 - a. Ductwork mains and branches and locations of balancing dampers, motor operated dampers, control devices, coils, etc.
 - b. Piping mains and branches and locations of isolation valves, balance valves, control valves, regulating valves, strainers, expansion devices or loops, air vents, etc.
 - c. Locations of all equipment.
 - d. Locations of all equipment controllers, control panels, sensors, control devices, etc.
 - e. Locations, inverts, and sizes of all underground piping and power.
 5. Record documents shall include all deviations from the Contract Documents including any substitutions.
 6. If the project requires the preparation of coordination drawings, the coordination drawings shall be submitted as record documents.

END OF SECTION 22 01 10

**SECTION 22 01 30
COORDINATION DRAWINGS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the requirements for coordination of all trades prior to installation of building systems and the requirements of deliverable coordination drawing sets.
- B. Provide pre-construction coordination of all trades and coordination drawings as described in this section.

1.03 SUBMITTALS

- A. Provide coordination drawings as herein specified.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. The Division 22 contractor shall prepare coordination drawings for the required Division 22 systems as outlined below and shall provide the drawings in the specified electronic format. Coordinate plumbing systems with all other trades of this project.
- B. Prepare coordination drawings in accordance with Division 1 Section "Project Coordination" and for all areas of the building as follows:
 - 1. Domestic water system horizontal distribution to risers.
 - 2. Each unique plumbing chase riser set including sanitary and domestic water systems. Typical conditions do not need to be duplicated. The intent is to identify clearance issues prior to installation.
 - 3. For all Mechanical Equipment Rooms and other areas where mechanical and plumbing equipment is installed.
 - 4. For all areas where careful coordination is needed for installation of products and materials fabricated by separate entities.
- C. Secure approval of coordination drawings from other trades affected, prior to submittal to the Architect for review. Each trade must indicate acceptance of illustrated conditions by attaching his endorsement to each drawing.
- D. Proceed with installation only after review of coordination drawings by the Architect and Engineer and approval from other trades affected.
- E. Plan the development of coordination drawings with the General Contractor's schedule for work.
 - 1. At the beginning of construction, submit a coordination drawing development schedule including an anticipated drawing list for development tracking.
 - 2. It is anticipated and acceptable for the contractor to submit coordination drawings based on the progression of the work areas identified in the project schedule.
- F. This Contractor shall keep a set of signed off coordination drawings, including updated changes, on the job site at all times and shall submit one (1) set of updated and legible "as-built" prints to the Architect when the work is complete.

1. Record any adjustments from original signed-off coordination drawings that were made during the final installation of the work. These shall be recorded in red ink on the prints. Changes shall be accurately dimensioned and/or drawn to scale.
2. Final marked coordination drawings shall be submitted as record documents.

3.02 DRAWING FORMAT

- A. Furnish all drawings in Autodesk Revit 2014 or later, and as agreed upon by all contractors prior to the commencement of coordination efforts.
- B. Scale: 1/4"=1'-0" minimum
- C. Final drawings shall be submitted as hard copy color prints as a shop drawing for review and approval by the Architect and Engineer.
- D. Trades and/or systems shall be assigned a separate color for easy distinction. Colors shall be assigned to all supporting Divisions by the Division 23 contractor.

3.03 RESTRICTIONS

- A. Photocopied, reproduced or traced drawings of the original Contract Documents shall not be used as coordination drawings.
- B. Electronic files of the original Contract Drawings will not be allowed to be used as coordination drawings.

3.04 REQUIRED SYSTEMS

- A. Piping and Equipment
 1. Sanitary and Vent
 2. Domestic water

3.05 REQUIRED CONTENT

- A. Quantities, dimensions and locations of equipment connections for piping, ductwork and electrical systems shall be verified with equipment suppliers and included in the preparation of coordination drawings.
- B. Show relation of all items of heating, ventilating and air conditioning equipment, ductwork and piping, plumbing equipment and piping and fire protection equipment and piping. Indicate all electrical devices that affect location of heating, ventilating, air conditioning and plumbing equipment, piping, ductwork and air inlets or outlets. Field measure and show existing items affecting new installation in remodeled areas. Questions and interferences shall be indicated on the coordination drawings for clarification by the Architect and Engineer. If there are not questions and interferences indicated on the coordination drawings, the Engineer and Architect shall assume that the drawings and specifications are complete and correct and will expect the intent of said documents to be complied with, and the installation to be complete in all respects according to said intent.
- C. Indicate location of all access panels required and coordinate type and location with General Trades.
- D. For Equipment Rooms and areas, coordination drawings shall show, but are not limited to the following:
 1. Floor drains and concrete housekeeping pads.
 2. All equipment, plumbing work and work of other trades, including floor supports and ceiling suspension systems showing manufacturers recommend installation requirements.
 3. All access areas around all equipment with clearances noted from floor to underside of mechanical and other trades work.
 4. All clear floor areas required for removal and cleaning of coils, filters, tubes, etc.

- E. Include all pertinent temperature control sensor locations, panel locations, power, network wiring, low voltage wiring, etc. that are required for interfacing and monitoring of plumbing equipment as indicated on the design drawings and/or described herein in the Division 22 specifications.
- F. Provide a coordinated set of wiring diagrams for motors, equipment items and temperature control showing line diagrams, power diagrams and terminal connections to ensure proper operation specified. Include provisions to accommodate equipment that is specified as an acceptable alternative from equipment that is the "Specified Standard" so that, if the acceptable alternative is installed, there will be no change in the Contract Sum.
- G. Secure from other trades (i.e., mechanical, structural, acoustical ceilings, fire protection, electrical, etc.) any information necessary for the development of coordination drawings. This information shall include, but is not limited to the following:
 - 1. Structural steel and slab layouts and details.
 - 2. Framing and suspension details for ceilings.
 - 3. Framing and suspension details for equipment suspended from structure above.
 - 4. Location and size of electrical pull boxes, conduit, buss ducts, cable trays, lighting fixtures, etc.
 - 5. Location and size of transformers, switchgear, and motor control centers, pneumatic transport tubes, etc.
- H. Existing Conditions
 - 1. Any existing pipe or equipment which will impact routing and layout of new work (such as existing storm drains and sanitary/vent piping), shall be field measured by this Contractor and shown on coordination drawings.

3.06 PHASING

- A. This project is broken into multiple phases of work. Spaces surrounding phased work areas are to remain occupied during construction. Many of these phases require demolition of and alterations to plumbing, and medical gas systems within the phased work area that affect surrounding areas outside of the phased work area. temporary piping to areas outside of each phased work areas shall be shown on coordination drawings to allow those areas to remain occupied during construction.

END OF SECTION 22 01 30

**SECTION 22 02 10
OWNER OPERATING AND MAINTENANCE TRAINING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the general requirements for the purpose of operations and maintenance training of the Owner's facility personnel on the systems and equipment installed or modified under this project's contract.
- B. Provide training to the Owner's designated personnel for all equipment and systems listed herein. Individual specification sections indicate the number of training hours required.

1.03 SUBMITTALS

- A. Submit to the Architect a schedule of all training sessions, topics to be covered, times, and attending personnel at least fourteen (14) days prior to the first session.
- B. Submit to the Architect a sign-in sheet from each training session, with all attending personnel, including contractor's training personnel and manufacturer's representatives, and the date, number of hours, and time of the training session.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Prior to acceptance of the work and after all equipment is in operation, provide to the Owner instructions for the purpose of training the Owner's personnel in all phases of operation and maintenance of equipment and systems provided under this Division.
- B. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instruction, and shall arrange to have the manufacturer's representatives present to assist with the demonstrations where specified.
- C. Operation and maintenance manuals shall be provided to the owner at least fourteen (14) days prior to the first training session.

3.02 TRAINING REQUIREMENTS

- A. The demonstrations shall consist of not less than the following:
 - 1. Point out the actual location of each component of a system and demonstrate its function and its relationship to other components within the system.
 - 2. Demonstrate each system by actual "start-stop" operation showing how to work controls, how to reset protective devices, how to replace components requiring regular maintenance, and what to do in an emergency.
 - 3. Demonstrate communication, signal, alarm and detection systems by actual operation of the systems and show how to reset signal, alarm and detection devices.

3.03 SCHEDULE AND AGENDA

- A. Submit a schedule of training events, including proposed date, starting time and ending time of each training session the Architect/Engineer, Commissioning Agent and Owner prior to the completion of construction for review and approval.
- B. Equipment and systems requiring a training session are indicated in each equipment and/or system's dedicated specification section.

- C. Indicate required attendees and proposed trainers required for each training session with the event schedule
- D. Indicate proposed training session topic, associated equipment, and rough training session agenda

3.04 COMMISSIONING AGENT

- A. If the project has a Commissioning Agent, the Commissioning Agent shall be present for all training sessions, when commissioning is specified for the project.

3.05 SIGN-OFF

- A. If the project has a Commissioning Agent, the Commissioning Agent shall verify completion of training sessions.
- B. Owner shall verify completion of training sessions.

END OF SECTION 22 02 10

**SECTION 22 03 10
PIPING SYSTEM FLUSHING AND TESTING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping systems' testing and cleaning requirements common to more than one section of Division 22. Portions of this Section may not be required in this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all piping testing and cleaning work described in this Section.

1.03 CODES AND STANDARDS

- A. All plumbing piping systems shall be tested in accordance with the applicable Plumbing Code.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 INSPECTIONS

- A. Obtain all piping inspections required by the authorities having jurisdiction over premises. Furnish all certificates of such inspections and include in the Operating and Maintenance Manuals. Pay all fees necessary for the inspections.
- B. No part of system shall be covered before inspection is made and approved. If covered before test, Contractor shall pay for cost of uncovering so test can be made and accepted.

3.02 TESTING - GENERAL

- A. Perform piping system pressure tests to all new piping systems prior to final connections to equipment and fixtures AND prior to connection to existing building piping. If equipment or fixtures are connected, they shall be isolated from the system during the test.
- B. Perform all tests before piping is concealed, insulated or heat traced.
- C. Contractor is responsible for completely draining the systems after hydrostatic tests are performed. Any damage from freezing prior to acceptance of the completed installation shall be repaired at no additional cost to the Owner.
- D. Correct minor leaks in welded joints by chipping out weld and re-welding. Correct leaks in screwed joints by replacing thread or fitting or both. Caulking of threaded joints is not permitted. Repair leaks in copper pipe by sweating out joints, thoroughly cleaning both pipe and fitting, and re-soldering.
- E. Pressure tests shall be witnessed by Owner's representative.

3.03 WATER SUPPLY SYSTEM TESTING

- A. Comply with the Ohio Plumbing Code, section 312 requirements.
- B. Tests shall be made with water (hydrostatic) or air, at a required pressure for a set duration, without appreciable pressure drop.

3.04 DRAIN AND VENT TESTING

- A. Comply with the Ohio Plumbing Code, section 312 requirements

3.05 BACKFLOW PREVENTION ASSEMBLY TEST

- A. Test all backflow preventer assemblies per the Ohio Plumbing Code and in accordance with ASSE standards upon completion of installation or relocation.

3.06 SYSTEM CHLORINATION – POTABLE DOMESTIC WATER SYSTEMS

- A. Flush the system with clean potable water until dirty water does not appear at outlets.
- B. Fill with a water/chlorine solution (50ppm chlorine) and allow to stand for 24 hours.
- C. Following standing time, flush the system with clean potable water until chlorine is purged from the system.
- D. Repeat chlorination, if necessary, until no bacteriological contamination is present in the system.
- E. Procedure shall conform to AWWA C651 and be accepted by the local health department.

END OF SECTION 22 03 10

**SECTION 22 03 20
EQUIPMENT AND SYSTEM START-UP**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes equipment and systems general start-up requirements, procedures, documentation, and submission requirements. See individual specifications sections for additional requirements.
- B. Furnish all materials, labor, and supervision to properly start-up equipment and systems provided under this Division and as required by this section.

1.03 SUBMITTALS

- A. Include a copy of all Equipment and System Start-up Forms in the Operations and Maintenance Manuals.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SCHEDULE

- A. Coordinate schedule for start-up, testing and adjustments of various equipment and systems with the Architect, other contractors and Owner.
- B. Contact all parties, including the Architect, required to witness equipment start-up as indicated in each equipment and system specification section of this division. Contractor shall give at least two (2) week's notice to all parties of scheduled start-up date and time.

3.02 EXAMINATION

- A. Prior to start-up verify the following:
 - 1. That each piece of equipment or system has been checked for proper lubrication, wiring, drive rotation, belt tension, control sequence or other conditions which may cause damage.
 - 2. That all tests, meter readings and specified electrical characteristics agree with those required by the equipment or system.
 - 3. That each piece of equipment or system is supported properly.
 - 4. Check equipment containing a separately coupled motor for proper motor and shaft alignment.
 - 5. Check vibration isolation devices to verify spring locks have been removed and vibration isolators are unconstrained.

3.03 LUBRICATION AND PACKING

- A. Properly lubricate all rotating or reciprocating equipment before it is started with correct grade, type and quantity of lubricant as recommended by manufacturer.
- B. Check each shaft containing a packing gland condition by backing packing gland off and examining for proper grade, amount and type of packing as recommended by manufacturer.
- C. Maintain all lubrication, gaskets and packing during construction. Assure that at the time of final project acceptance all are in first class condition.

3.04 CORRECTION OF DEFICIENCIES

- A. Any conditions found to be unsatisfactory to the standards outlined by the manufacturer or these specifications during the cursory pre-start-up examination process shall be corrected prior to actual start-up of equipment and systems.

3.05 EQUIPMENT AND SYSTEM START-UP

- A. Follow manufacturer's recommendations and requirements for start-up of equipment.
- B. Document date of equipment start-up for commencement of manufacturer's warranty.
- C. If required by the specific equipment or system specification section, provide the following:
 - 1. Factory authorized personnel present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
 - 2. Submit a written report that equipment or system has been properly installed and is functioning correctly.
- D. During the start up testing or adjustment period, maintain on the project, a contractor representative thoroughly familiar with all phases of the project for as long a period as required to start up all equipment and systems and demonstrate that they are functioning properly.
- E. Contractor is responsible for furnishing any and all instruments required to start up and test equipment or systems which include thermometers, electric meters, pressure gauges, etc.

3.06 ADJUSTMENTS

- A. Contactor shall make adjustments, if required, to equipment and systems after starting them up and observing them operate for a sustained period of time. Corrections shall be made if systems are excessively noisy or vibrating excessively.
- B. The Engineer or his representative, may make spot checks to determine the accuracy and completeness of final adjustments. Should spot checks indicate more than a reasonable deviation from design requirements, the Contractor shall repeat tests and adjustments to the satisfaction of the Engineer.

END OF SECTION 22 03 20

**SECTION 22 04 20
PAINTING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies painting requirements for this division and includes descriptions of piping and equipment included as part of this division's contract and general application methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. Finishing (paint, wall covering, etc.) shall not be included under this Section.

PART 2 PRODUCTS

PART 3 PRODUCTS

3.01 GENERAL

- A. Where indicated, all painted metal surfaces shall be primed and painted with an oil based paint. Apply painting to the following areas utilizing Sherwin-Williams paints indicated or an equivalent paint provided by one of the approved manufacturers:
 - 1. Ferrous Metal (Exterior): One coat Galvite HS and two coats All Surface Alkyd Enamel.
 - 2. Ferrous Metals (Interior): Spot prime abraded areas with All Surface Enamel Primer and two coats ProClassic Alkyd Interior Enamel.
 - 3. Insulated Coverings: One coat Fast Drying Primer and two coats ProMar 400 Alkyd Semi-Gloss.
- B. Where colors are indicated to match adjacent building finish, the Architect/Engineer shall make final color selection.
- C. Equipment touch up painting shall match the equipment finish.
- D. See Part 3 – Execution for piping, supports and equipment to be painted.

3.02 ACCEPTABLE MANUFACTURERS

- A. Painting shall be done with products as manufactured by Pittsburgh Plate Glass, Sherwin-Williams, Pratt and Lambert, or Glidden.
- B. Equipment touch up painting shall match the equipment finish.

PART 4 EXECUTION

4.01 LOCATIONS REQUIRING PAINTING

- A. All existing exterior natural gas piping above grade:
 - 1. Color selection to match adjacent building or surroundings where exposed to public view. Final color selection shall be made by the Architect/Engineer.
- B. All interior natural gas piping
 - 1. Color shall be yellow.
- C. All interior Fire main and standpipe risers.
 - 1. Color shall be red.
- D. General:

1. Exposed blacksteel iron work including, hangers, pipe, pipe covering, equipment casings or enclosures, tanks, and ductwork exterior to mechanical equipment rooms.
2. Where equipment is complete with a factory finish, additional painting is not required unless directed by the Architect/Engineer (requiring a color change).
3. "Exposed" as indicated above, shall refer to exposed to view and shall not include piping or materials concealed above ceilings, under floor slabs, or buried in walls.

4.02 INSTALLATION REQUIREMENTS

- A. Materials and equipment installed under this Division shall be left free from dirt, grease and foreign matter, ready for painting.
- B. No equipment or piping shall be painted before being tested.
- C. Damaged surfaces of prefinished materials and equipment shall be touch-up painted to match existing finish.
- D. Comply with manufacturer's recommendations for mixing and application.
- E. Do not paint over name plates, labels, identification tags, signs, markers, etc.

4.03 FIELD QUALITY CONTROL

- A. Provide protective drop coverings for all permanent finishes and surfaces while applying paint and until the final coating has dried to protect from excess paint spills, drips, etc.

4.04 CLEANING

- A. Clean excess paint from any surfaces not meant to be painted.
- B. Remove protective coverings once final paint coat has dried.

END OF SECTION 22 04 20

SECTION 22 04 30
EXCAVATING, TRENCHING, BACKFILLING, AND PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.
- C. Division 3 "Concrete" Specifications complement the requirements of this Section.
- D. Division 3 "Asphalt" Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes excavating, trenching, backfilling and paving procedures and requirements for the proper installation of underground plumbing systems.
- B. This section describes the acceptable materials and installation methods to provide housekeeping pads, curbs, rails, inertia bases, etc., for equipment furnished under this Division.
- C. Furnish all equipment, materials, labor, and supervision necessary to provide cast-in-place concrete housekeeping pads, curbs, rails, inertia bases, etc., as described herein and where indicated on the drawings. Extent of plumbing related work required by this Section is indicated on drawings and/or specified in other Division 22 Sections.
- D. Furnish all materials, equipment, labor, and supervision required to excavate and backfill to facilitate underground plumbing piping and utility work both inside and, where indicated, outside the building.
- E. Each Contractor shall be responsible for all excavating and backfilling work required for installation of their work for this project, unless noted otherwise in this specification or on the drawings.

1.03 QUALITY ASSURANCE

- A. Codes and Standards
 - 1. Excavation Work:
 - a. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
 - b. Prior to any excavation on the site, each contractor shall provide notification to The Ohio Utilities Protection Service (800-362-2764) a "utilities protection service".
 - c. This Contractor shall check with the Architectural drawings concerning the test borings to determine areas of rock which should be included in his excavation work. Failure to adjust for rock conditions shall not warrant cause for additional compensation.
 - 2. Sanitary and Storm Sewers, Gas, Water and Fire Service Mains:
 - a. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary and storm sewage systems, gas, water and fire protection systems.
 - b. Utility Compliance: Comply with local utility requirements, regulations and standards pertaining to sanitary and storm sewerage systems, gas, water and fire protection systems.
 - 3. Paving:

- a. Concrete Work Codes and Standards: Comply with governing regulations and, where not otherwise indicated, comply with industry standard in its application to work in each instance.
 - 1). ACI 301 "Specifications for Structural Concrete Buildings."
 - 2). ACI 381 "Building Code Requirements for Reinforced Concrete."
 - 3). Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

1.04 COORDINATION, SEQUENCING AND SCHEDULING

- A. Coordinate locations and routing of underground building sanitary and storm drainage piping, gas piping, fire protection piping and water piping.
- B. Coordinate work with other utility work.
- C. Coordinate the shut off and disconnection of utility services with the Owner and the utility company.
- D. Notify the Architect at least 5 days prior to commencing excavation work and any disruption to existing utilities.

1.05 PROJECT CONDITIONS

- A. Protect adjacent finish materials against spatter during concrete placement.

PART 2 PRODUCTS

2.01 BUILDING FLOORING

- A. Concrete
 - 1. Materials shall be same as specified in Division 3, "CONCRETE".

2.02 CONCRETE RELATED MATERIALS

- A. Forms for exposed finish concrete work shall be of lumber, metal, metal-framed or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
 - 1. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
 - 2. Welded Wire Reinforcing Fabric: ASTM A 185, welded steel wire fabric.
 - 3. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place.

2.03 CONCRETE MATERIALS

- A. Materials for concrete work shall comply with requirements of Division 2 "Portland Cement Concrete Paving" Section.
- B. Portland Cement: ASTM C 150, Type I.
- C. Use one brand of cement throughout project, unless otherwise acceptable to Architect. Prepare design mixes for each strength of concrete indicated.
 - 1. Fly Ash: ASTM C 618, Type C or Type F.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Course Aggregate: ASTM C 33, crushed gravel.

2.04 DESIGN AND PROPORTIONING OF CONCRETE MIXES

- A. General: Design mechanical work concrete as follows, for each 28-day compressive strength class:
 - 1. 3000 psi Class: 500 lbs. of cement per cu. yard (5.25 sacks) and 0.46 water/cement ratio.

2.05 BUILDING FLOORING

- A. Concrete
 - 1. Materials shall be same as specified in Division 3, "Concrete"

2.06 EXTERIOR PAVEMENT

- A. Asphalt Parking Lot
 - 1. Materials shall be same as specified in Division
- B. Concrete Sidewalk
 - 1. Materials shall be same as specified in Division 3, "Concrete"

PART 3 EXECUTION

3.01 PROTECTION OF BUILDING AND SITE CONDITIONS

- A. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies and Owner for shut off of services if lines are active.
- C. Uncharted or Incorrectly Charted Utilities: Document actual routes for inclusion in as-built drawings. Contact Engineer and Owner if actual route of existing underground utilities requires revisions to the design.
- D. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations.
- E. Use of explosives is not permitted.
- F. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install mechanical work on frozen excavation bases or subbases.
- G. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Where trenches cross roads, walks or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during day and lights at night.
- H. Operate warning lights as recommended by authorities having jurisdiction.
- I. Site Information: Perform site survey, research public utility records and verify existing utility locations. Verify that gas, water, fire protection, sanitary and storm sewerage system piping may be installed in compliance with original design and reference standards. Subsurface conditions were investigated during the design of the project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.

3.02 EXCAVATION

- A. See also Division 2, "SITE WORK".
- B. Do not excavate for plumbing work until work is ready to proceed without delay so that total time lapse from excavation to completion of backfilling will be kept at a minimum.
- C. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace as required for stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling. Maintain shoring and bracing in excavations throughout time period excavations will be open. Carry down shoring and bracing as excavation progresses. Contractor is referred to the "General Conditions" which defines responsibility for damage which may be incurred in the course of excavating.

- D. For deep excavation shoring and bracing, provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable condition.
- E. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
- F. De-watering:
 - 1. Lay no pipe in water. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Furnish all pumping equipment, power, temporary connections, etc. and do all pumping necessary to remove ground or casual water.
 - 2. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to stability of subgrades. Provide and maintain pumps, well points, sumps, suction and discharge lines and other de-watering system components necessary to convey water away from excavations.
 - 3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run off areas. Do not use trench excavations as temporary drainage ditches.
- G. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
- H. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
- I. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- J. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.
- K. Trenching:
 - 1. Excavate trenches for underground installations to exact grade and depth with only sufficient dirt removed at bell holes to provide working space. Any trenches dug below required depth shall be filled to proper depth with sand. Trenches shall not be more than 18" wider than external diameter of pipe.
 - 2. Limit the length of open trench to that in which pipe can be installed, tested and the trench backfilled within the same day.
 - 3. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6" of stone or gravel cushion between rock bearing surface and pipe.
 - 4. Where trenches cross roads, walks or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during the day and lights at night.
 - 5. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.
- L. Exact routing of trenching shall be determined by the Contractor and approved, in advance, by the General Contractor and the Architect/Engineer.
- M. Every effort has been made to indicate on the drawings those existing underground services expected to interfere with or be affected by new construction.

1. It shall not be assumed that no other services exist. The Contractor shall have the responsibility to confirm all underground utilities by contacting the proper authorities before any excavation is started.
 2. The Contractor shall exercise necessary precautions in process of excavation to avoid damage to unknown or unrecorded services.
 3. Should such mechanical service be encountered either by the Contractor or other Contractors, it shall be the responsibility of the Contractor to determine whether such mechanical service is actively in use.
 4. In the event such service is found, which had not been so noted previously, to be in use, disposition of such service shall be determined by the Architect, and an equitable adjustment to the Contract amount made.
 5. In the event such service, if found to be inactive or abandoned, that part of service found to be inactive or abandoned which interferes with new work shall be removed; remaining terminals shall be plugged as required and in accordance with applicable codes under this Division of the Specifications, and as directed by the Architect.
 6. Notify the Owner prior to any excavation on the site or inside the existing building.
- N. Where rock and/or shale is encountered for excavation of trenches for installation of site utilities and underground building mechanical services, the rock and shale must be removed by appropriate methods to a depth of one fourth the diameter of the pipe, but not less than 4", below the bottom of the pipe; bottom of trench: refilled with sand or pea gravel to a depth required to provide proper grade or utility service and properly support pipe.
- O. See Division 2 "SITE WORK", relating to excavation and sealing of pyrites-bearing shale where encountered on the project site.
- P. Maintain sides and slopes of excavations in a safe condition until completion of backfilling. For deep excavations provide all required shoring and bracing.
- Q. Excavate to required depth and exact slope with only sufficient dirt removed at joint locations to provide working space. Any excavations dug below the required depth shall be filled to proper depth with sand and thoroughly tamped.
- R. After piping is installed, excavation shall be kept open until piping has been inspected, tested and accepted.
- S. Where trenches cross roads, walks or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during day and lights at night, and as directed by Architect.

3.03 BACKFILLING

- A. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Inspection, testing, approval and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing and backfilling of voids.
 4. Removal of trash and debris.
- B. All backfilling within the building shall consist of an initial 12" layer of sand over the pipe. The remainder of the backfill shall be bank run gravel.

- C. All backfilling outside the building shall be selected dirt, free of large stones, tamped on 10" layers for the first 30 inches. After initial cover, puddling will be permitted for settling of the remainder. This shall be followed by thorough tamping of the top. Trenches shall, after being refilled in accordance with the previous instructions, be mounded 6" above grade to provide for settlement. If necessary, before acceptance of work, trenches shall be filled and tamped again. Backfilling shall not be done until pipe lines are properly tested in the presence of the Architect and/or inspection of the government agency having jurisdiction.
- D. Control trench soil compaction during construction for compliance with the maximum density specified in the following areas:
 - 1. For building slabs, walkways, roadways or public thoroughfares; compact top 12" of subgrade and each layer of backfill for fill material at 95% density for cohesionless soils and 90% density for cohesive soil material. Tests to be performed by an independent testing service, with compliance report submitted to the Architect.
- E. Backfill about the structures shall be placed, when practical, as the work of construction progresses. Backfilling on or against concrete work shall be done only when directed.
- F. Backfilling shall progress as rapidly as the testing and acceptance of the finished sections of the work will permit and shall be carried to a crown approximately six (6) inches above the existing grades. In backfilling around duct lines, selected material shall be compacted firmly around and to a depth of not less than six (6) inches over the top of the duct. Rough grading shall be compacted thoroughly in layers and shall be brought up to within six (6) inches of finished grades. Fill and backfill shall be clean and free from vegetative matter, sticks, rocks and refuse.
- G. Backfill under roadways, drives and parking areas shall be bank run gravel or approved granular material.
- H. Where building service lines, such as, water, sewers, gas, fire service, etc., enter or leave building and are installed on disturbed earth, backfill, or unstable base, provide continuous support on reinforced concrete beam furnished and installed under this division. Support beam at building wall and on undisturbed earth at other end as required and/or as indicated in details on the drawings. The general Contractor is responsible for maintaining undisturbed earth portion of beam support.
- I. Each Contractor shall remove from the site all excess excavated materials resulting from performance of his contract work under this division, or as directed by the Architect.

3.04 NATURAL GAS PIPE AND BACKFILLING

- A. Install underground gas piping per manufacturer's recommendations in a minimum trench bed width equal to one foot wider than the nominal pipe diameter and 24" deep.
- B. Place piping on a 6" bed of tamped sand with 6" sand cover.
- C. In general, the material excavated from the trench may be used as backfill.
- D. Final grading and seeding shall be provided under this section as specified in Division 2 of these specifications.
- E. Provide yellow insulated underground copper tracer wire or other approved conductor. Provide adjacent to underground non-metallic pipe. Tracer wire shall terminate above ground at each end of the non-metallic piping. Include identification tape: yellow with black lettering "Natural Gas".

3.05 RESTORATION

- A. Repave all streets or sidewalks disturbed by work performed under this division at the responsible Contractor's expense, to satisfaction of the Architect, and authorities having jurisdiction, and in accordance with details shown on "SITE WORK" drawings.
- B. Full sections of concrete walks shall be removed and replaced to match.

- C. Asphalt shall be trenched in straight lines, backfilled with granular fill (i.e., sand) in 6" layers, hand tamped after each layer, and patched with a minimum of 5 inches of O.D.O.T. #404 asphalt, installed in maximum 2" lifts.
 - 1. Existing excavated asphalt and surplus sub-base shall be removed from the job site by the general Contractor.
 - 2. Finished asphalt surface to be graded such as to avoid "ponding" of surface rain water.
- D. Grassy areas shall be backfilled with best grade topsoil that is free of all rocks and debris, compacted in layers and carried to a crown of approx. 6" above existing grade. Rake to remove all stones, heavily seed (fairlawn mix) and install 3" thick cover of straw.

3.06 INSTALLATION OF IDENTIFICATION

- A. Install continuous plastic underground warning tape during backfilling of trench for underground piping. Locate 6" to 8" below finished grade, directly over piping.

3.07 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.

3.08 INSTALLATION OF CONCRETE WORK

- A. Formwork:
 - 1. General: Design, construct, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so that formed concrete will be of required size, shape, alignment, elevation, and position.
 - a. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates furnished by equipment manufacturers, to locate anchor bolts, or where not furnished, locate by accurate measure from certified setting diagrams.
- B. Placing Reinforcement:
 - 1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
- D. Chamfer exposed corners and edges using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- E. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support built into forms.
- F. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Re-tightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.
- G. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

- H. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- I. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.09 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.10 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50° F for 24 hours after placing concrete, provided concrete sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

3.11 CONCRETE PLACEMENT

- A. Pre-placement inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where coatings are not used.
- B. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
- C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- D. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
- E. Placing Concrete Slabs: Deposit and consolidate slabs in a continuous operation within limits of construction joints, until the placing of a panel or section is completed.
- F. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- G. Bring slab surfaces to correct level with straightedge and strike-off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- H. Maintain reinforcing in proper position during concrete placement operations.

3.12 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
- C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
 - 1. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40°F, heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50°F, and not more than 80°F, at time of placement. Protect concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.
 - 2. Finishing Horizontal Surfaces: Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struck-off surface undisturbed, except scratch surfaces which are to receive concrete or mortar topping or setting bed, by raking with a stiff broom.

3.13 MISCELLEANEOUS CONCRETE ITEMS

- A. Curbs: Provide monolithic finish on interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to hard, dense finish with corners, intersections and terminations slightly rounded and coved.
- B. Equipment Bases and Foundation: Provide equipment bases and foundations, as shown on drawings. Set anchor bolts for equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing equipment.
- C. In the absence of more specific information, either on the drawings, or in manufacturer's literature, concrete bases shall be level, shall have a minimum height above finished floor of 4" and extend 3" beyond the skids, feet or bed plate of the item of equipment.
- D. Concrete pads, pedestals, or saddles placed in existing structures shall be mounted securely to the original substrate with anchor bolts.
- E. Grout base plates and foundation as indicated, using non-shrink grout. Use non-metallic grout for exposed conditions.

3.14 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.
- B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods, and bolts, down to solid concrete but, in no case to a depth of less than 1 qt. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar after bonding compound has dried.
 - 1. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
 - 2. Exposed Surfaces: On formed which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with grout and completely removing fins and other projections.

3.15 CLEANING

- A. Clean exposed surfaces, floors, equipment, ductwork, piping, etc., of residual debris and particulates when interior concrete patching is complete.
- B. Clean exterior surfaces of all residual material once exterior pavement and sidewalk patching is complete.
- C. Remove leftover patching materials and equipment from the site once patching is complete.

END OF SECTION 22 04 30

SECTION 22 05 10
ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.
- C. Separate electrical components and materials for field installation and electrical connections are specified in Division 26.

1.02 SCOPE

- A. This Section specifies basic requirements for electrical components which are an integral part of plumbing equipment.
- B. Specific electrical requirements for plumbing equipment are scheduled on the Drawings or described in other Sections of Division 22.
- C. Provide all materials, equipment, labor and supervision necessary to install all electrical components and devices described in this Section.
- D. All field wiring of components and devices described in this Section shall be by the Electrical Contractor as specified in Division 26 unless noted otherwise.

1.03 CODES AND STANDARDS

- A. All electrical devices and enclosures shall comply with NEMA and IEEE Standards for the specific application in which installed.
- B. Electrical components and integral wiring shall comply with the National Electrical Code (NFPA 70).
- C. Electrical components and materials shall be UL labeled.

1.04 SUBMITTALS

- A. For electrical components which are an integral part of packaged mechanical equipment, no separate submittal is required. Submit product data for enclosures and other electrical components with submittal data required for the equipment for which it serves, as requires by the individual equipment specifications.
- B. Submit manufacturer's electrical requirements for power supply wiring. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide motors as manufactured by one of the following:
 - 1. A.O. Smith
 - 2. Baldor (Reliance)
 - 3. Emerson
 - 4. General Electric
 - 5. Leeson
 - 6. Louis Allis
 - 7. Marathon Electric
 - 8. Teco-Westinghouse.

2.02 GENERAL

- A. All plumbing equipment control panel and electrical device enclosure covers shall be provided with defeatable interlocks to permit opening of panel (by qualified personnel) while equipment is in operation.
- B. Fabricate plumbing equipment for secure mounting of motors and other electrical items integral with the equipment. Provide either permanent alignment of motors with equipment or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives, arranged for lubrication and similar running-maintenance without removal of guards. Guards shall include opening for insertion of revolution counter at motor drive sheave.

2.03 MOTORS

- A. For each item of equipment requiring electric drive, provide an induction motor having starting and running characteristics consistent with the torque and speed requirements of the driven equipment. In no case shall power requirements of the driven equipment exceed the nominal nameplate rating of the furnished motor (do not take advantage of service factors in selecting motors). For design, construction and performance characteristics conform to applicable provisions of latest NEMA and IEEE standards for rotating electrical equipment.
- B. Unless otherwise specified, motors are to be general-purpose open-drip proof type, with Class B insulation, rated for continuous operation in 40°C ambient temperature. **All motors utilized with variable frequency drives shall be "inverter ready" motors with class F insulation in accordance with NEMA MG1 Part 31.4.4.2. All motors utilized with variable frequency drives shall be provided with a shaft ground ring in compliance with NEMA MG1 31.4.4.3.**
 - 1. Unless otherwise scheduled on the drawings, motors 1/2 HP and smaller shall be single phase, capacitor start type, with ball bearings. Shaded-pole type with sleeve bearings are acceptable only for motors less than 1/16 HP.
 - 2. Unless otherwise scheduled on the drawings, motors 3/4 HP and larger shall be three phase, squirrel-cage type with ball bearings.
 - 3. Ball bearings shall be regreasable, except where motor is normally inaccessible for regular maintenance, permanently sealed ball bearings shall be provided.
- C. Motors shall have a minimum efficiency as follows in accordance with IEEE Standard 112, test method B. If horsepower is not listed, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112, test method B.
- D. Motors shall be furnished with stainless steel nameplate indicating manufacturer, ratings, characteristics, construction, efficiency and special features.

2.04 MANUAL MOTOR STARTERS

- A. In general, single phase motors shall be equipped with manual motor starters. Manual motor starters shall be provided and installed by the electrical contractor as specified in Division 26 unless noted otherwise on the Division 22 drawings or in the Division 22 specifications.
- B. Enclosures in dry indoor locations shall be general purpose NEMA Type 1, unless noted otherwise. Enclosures in wet indoor or outdoor locations shall be NEMA Type 4 (stainless steel, unless noted otherwise).
- C. Manual motor starter shall include neon pilot light, "Quick-make, quick-break" trip-free toggle mechanism and melting alloy thermal overload relay sized to protect the motor.

2.05 COMBINATION MOTOR STARTERS

- A. In general, three phase motors shall be equipped with combination motor starters. Combination motor starters shall be provided and installed by the electrical contractor as specified in Division 26 unless noted otherwise on the Division 22 drawings or in the Division 22 specifications.

- B. Enclosures in dry indoor locations shall be general purpose NEMA Type 1, unless noted otherwise. Enclosures in wet indoor or outdoor locations shall be NEMA Type 4 (stainless steel, unless noted otherwise).
- C. Size of starters shall be as recommended by the motor or driven equipment manufacturer.
- D. Combination motor starters shall include a disconnect as specified in the following section "2.5 Disconnect Switches". Starter shall be furnished with the following devices:
 - 1. "HAND-OFF-AUTO" selector switch in cover.
 - 2. Heavy duty push-to-test red pilot light to illuminate when motor is running.
 - 3. Control power transformer (coordinate secondary voltage with required control voltage). Control transformer primary shall be connected to the load side of the incoming line disconnect fuses and the secondary shall be fused and grounded.
 - 4. Three (3) bi-metal type thermal overload elements. The starter shall be inoperative if any thermal element is removed.
 - 5. Minimum of two NO/NC field convertible auxiliary contacts. Two NO and two NC contacts may be furnished in lieu of convertible contacts.
 - 6. Engraved nameplate on the door describing the equipment controlled.

2.06 DISCONNECT SWITCHES

- A. Disconnect switches shall be provided and installed by the electrical contractor as specified in Division 26 unless noted otherwise on the Division 22 drawings or in the Division 22 specifications.
- B. In dry indoor locations, enclosures shall be general purpose NEMA Type 1, unless noted otherwise. In wet indoor or outdoor locations enclosures shall be NEMA Type 4 (stainless steel), unless noted otherwise.
- C. Size of disconnect switches shall be as recommended by the motor or driven equipment manufacturer.
- D. Disconnect switches shall be fusible type, with Class R rejection fuse clips.
 - 1. The disconnect handle shall always be in control of the disconnect device with the door open or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "ON" or "OFF", and shall include a two-color handle grip, the black side visible in the "OFF" position indicating a safe condition, and the red side visible in the "ON" position indicating a dangerous condition.
 - 2. Disconnect handle shall contain provisions for padlocking in the "OFF" position.
 - 3. If required, the disconnect switch shall be furnished with one auxiliary SPDT contact for use by the Controls Contractor to de-energize remotely powered interlock wiring when the disconnect is in the "OFF" position.
- E. Disconnect switches shall be furnished with a ground lug.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 HP and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Install starters and wiring devices at location indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate for proper operational access, including visibility, and for safety.

- C. Install power and control connections for motors to comply with NEC and applicable provision of Division 26 sections. Install grounding except where non-grounded isolation of motor is indicated.
- D. Prior to the purchase or installation of any equipment, verify all motor voltage characteristics with the Electrical Contractor.
- E. Make final electrical connection to all motors with flexible metal conduit unless plug-in electrical cords are specified. Line voltage terminations shall be by the Electrical Contractor.

END OF SECTION 22 05 10

**SECTION 22 07 10
PENETRATIONS AND SLEEVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section specifies basic requirements for walls, roof and floor penetrations.
- B. Furnish all equipment, materials, labor, and supervision necessary to make all required mechanical penetrations as described herein.

1.03 CODES AND STANDARDS

- A. Underwriters' Laboratory (UL)
- B. ASTM E-84 (NFPA 255)

1.04 SUBMITTALS

- A. Slab-on-grade floors and below-grade wall penetration seal: Submit manufacturer's cutsheet(s), including dimensions, materials, installation recommendations, ratings and code compliance information, etc.
- B. Shop Drawings: Provide, per requirements of Section 22 01 20.

PART 2 PRODUCTS

2.01 BELOW-GRADE WALL AND SLAB-ON-GRADE FLOOR PENETRATION SEALS

- A. Mechanical seals shall consist of intumescent synthetic rubber plugs, plastic or stainless steel pressure plates, and stainless steel bolts.
- B. Subject to compliance with requirements, provide below-grade wall and floor slab penetration seals as manufactured by one of the following:
 - 1. Metra-Flex
 - 2. Thunderline Corp

2.02 PIPE SLEEVE MATERIALS

- A. Schedule 40 black steel pipe.

2.03 SOUND STOPPING

- A. Fiberglass insulation, 2 lb density.
- B. Material shall be non-asbestos and non-friable.
- C. Provide all insulation materials with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

2.04 ESCUTCHEONS

- A. Escutcheons shall be chrome plated brass.

PART 3 EXECUTION

3.01 GENERAL

- A. Pipe sleeves are required at all pipes penetrating concrete walls, masonry walls, fire walls and smoke barrier walls.
- B. Where concrete or masonry walls are core drilled for pipe passage, steel sleeves are not required.
- C. Where concrete floor slabs or concrete roof slabs are core drilled for pipe passage, steel sleeves are not required – except in mechanical rooms and all rooms containing water piping.

- D. In new concrete walls, floors, and roofs, coordinate the exact locations of pipe sleeves with the General Trades Contractor performing the work prior to concrete pour.
- E. Each Contractor is responsible to furnish and install his own pipe sleeves.

3.02 CUTTING AND PATCHING

- A. This Contractor shall provide all penetrations in new and existing construction required for the installation of fixtures, plumbing piping, conduit, and equipment. Do not cut any structural member without specific permission from the Architect.
- B. Penetrations shall be cut as small as practical with as little damage as possible and in a manner satisfactory to the Architect.
- C. This Contractor shall patch all penetrations and repair all damage caused by the installation and/or removal of plumbing systems. All materials shall be new and shall match the adjacent construction.
- D. Finishing (paint, wall covering, etc.) shall not be included under this Section.
- E. The General Trades Contractor shall flash all plumbing vents into roofing system.

3.03 MASONRY OR CONCRETE WALL BELOW-GRADE AND FLOOR SLABS ON-GRADE:

- A. Sleeves shall be one inch (1") larger than the outside diameter of the pipe including insulation where applicable, or two pipe sizes larger, whichever is bigger.
- B. Set pipe wall sleeves with ends of sleeves flush with wall faces. Set pipe floor sleeves with top of sleeve 4 inches above finished floor in water entry rooms, Mechanical rooms, and wet floor locations.
- C. Center pipes in sleeves.
- D. Provide below-grade mechanical wall and floor penetration seals to fill the annular space between the pipe and floor slab or outside wall and sleeve. Center penetration seal within the opening. Comply with penetration seal manufacturer's installation instructions.

3.04 MASONRY OR CONCRETE WALL ABOVE-GRADE

- A. Sleeves shall be one inch (1") larger than the outside diameter of the pipe including insulation where applicable, or two pipe sizes larger, whichever is bigger.
- B. Set pipe sleeves with ends of sleeves flush with wall faces.
- C. Center pipes in sleeves.
- D. For fire or smoke rated walls, fill the annular space between the pipe and the sleeve with the proper firestopping material. See "Firestopping" specification section, this Division for products and installation methods.
- E. For unrated walls, fill the annular space between the pipe and the sleeve with sound stopping.

3.05 CONCRETE FLOOR OR ROOF:

- A. Sleeves shall be 1 inch larger than the outside diameter of the pipe, or two pipe sizes larger, whichever is bigger.
- B. Set pipe sleeves with top of sleeve flush with roof slab or deck surface.
- C. Set pipe sleeves with top of sleeve to be 4 inches above finished floor in water entry rooms, Mechanical rooms and wet floor locations.
- D. Center pipes in sleeves.
- E. For fire or smoke rated floors and roofs, fill the annular space between the pipe and the sleeve with the proper firestopping material. See "Firestopping" specification section, this Division for products and installation methods.
- F. For unrated floors and roofs, fill the annular space between the pipe and the sleeve with sound stopping. Note – roof penetrations shall be made via roof curbs.

3.06 SOUND STOPPING

- A. Where pipes or other components of Division 22 work pass through non-fire rated walls, provide sound stopping between such work and the wall material intended to reduce the transmission of sound from one side of the wall to the other.
- B. Sound stopping of pipes in sleeves shall consist of sealing the outside of the sleeve with caulking and the inside with an insulating material.
- C. Sound stopping of pipes without sleeves shall consist of packing the cavity around the penetration with an insulating material and sealing the opening with approved sealant or plaster.
- D. Insulating materials shall be non-asbestos and non-friable, and shall have a flame spread rating of no more than 25 and a smoke developed rating of no more than 50.

3.07 ESCUTCHEONS

- A. Fit all pipe passing exposed through walls, floors, or ceilings in finished rooms with chrome-plated brass escutcheons. Where adjacent surface is to receive a paint finish, prime paint escutcheons, otherwise escutcheons shall be chrome plated. Provide escutcheons on all plumbing piping wall penetrations within counters.

END OF SECTION 22 07 10

**SECTION 22 07 20
FIRESTOPPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section specifies firestopping materials and installation requirements for the penetration of rated assemblies. Portions of this Section may not be required in this project. Actual field conditions, penetration type (pipe, etc.) and assembly type, shall define exact firestopping requirements.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in the Section.

1.03 QUALITY ASSURANCE

- A. The firestop system installation shall be UL Listed and tested in accordance with ASTM E814.
- B. Fire rating of the firestop system shall be equivalent to the assembly which is penetrated.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Hilti, Inc.
 - 2. 3M; Fire Protection Products Division.
 - 3. Thermafiber Safing
 - 4. Specified Technologies Inc.
 - 5. FireTrak Corp.

2.02 MATERIALS

- A. All products used under this Section shall be UL listed for the purpose.
 - 1. Piping, ductwork, and sleeve penetrations of rated assemblies shall be sealed with the appropriate intumescent caulk, putty, strip, block, or sheet type fire barrier product
- B. Fire barrier products shall be installed in accordance with all U.L. System requirements for the type of penetration and firestopping system used. The following U.L. System descriptions are those of Hilti Inc. firestopping systems.

Table 22 07 20.1

Penetration (F rating)	UL System
Metal pipe through gypsum board (1 or 2 hour)	Hilti UL #WL1054 or approved equal
Metal pipe through masonry/concrete (2 hour)	Hilti UL #CAJ1291 or approved equal
Metal pipe through poured concrete floor slab (3 hour)	Hilti UL #FA1017 or approved equal
Insulated metal pipe through gypsum board (1 or 2 hour)	Hilti UL #WL5029 or approved equal
Insulated metal pipe through masonry/concrete (2 hour)	Hilti UL #CAJ5091 or approved equal

Penetration (F rating)	UL System
Insulated metal pipe through poured concrete floor slab (2 hour)	Hilti UL #FA5017 or approved equal
Plastic pipe through gypsum board (1 or 2 hour)	Hilti UL #WL2078 or approved equal
Plastic pipe through masonry/concrete (2 hour)	Hilti UL #CAJ2271 or approved equal
Plastic pipe through poured concrete floor slab (3 hour)	Hilti UL: #FA2054 or approved equal

1. Actual project conditions may require a UL System not specifically described above. Fire barrier products manufacturer shall provide a UL System to meet actual project conditions.

PART 3 EXECUTION

3.01 GENERAL

- A. All penetrations (pipe, etc.) through fire rated assemblies shall be firestopped.
- B. All firestopping materials shall be installed per the manufacturer's instructions.
- C. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the Architect.
- D. Unused sleeves or core drilled holes shall be plugged with fire resistant material and finished to match adjacent surfaces.
- E. Finish surfaces of firestopping, which is to remain exposed to view, to a uniform and level condition.
- F. Field Quality Control:
 1. All areas of work must be accessible until notification and inspection by the applicable Code authorities.
 2. Have firestops examined by proper authorities to ensure proper installation and full compliance with this specification. If required, show proof of compliance by providing the appropriate UL firestopping system number.
 3. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.
- G. If requested, the Contractor shall show proof of compliance by providing the appropriate UL firestopping system number to the inspection Authority Having Jurisdiction or the Architect.

END OF SECTION 22 07 20

**SECTION 22 07 40
MISCELLANEOUS STEEL SUPPORTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the materials, fabrication, and installation requirements miscellaneous steel supports, structures, and reinforcements required for the proper installation of plumbing systems and equipment.
- B. Furnish all material, equipment, labor, and supervision necessary to provide steel supports, structures, and reinforcements as required by this division of the specifications.

1.03 CODES AND STANDARDS

- A. Design all miscellaneous steel in accordance with AISC Steel Handbook .

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. Furnish and install all miscellaneous steel for supports, structures, hangers, anchors, guides, etc., required for installation of equipment and material furnished and installed under this division.
- B. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.
 - 1. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.
 - 2. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
 - 3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- C. Delete three paragraphs and associated subparagraphs below not applicable to Project. Insert others where needed to specify requirements applicable to a specific item not covered under general installation requirements above.
- D. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with nonshrink, nonmetallic grout.
- E. Touch up surfaces and finishes after erection.
 - 1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
 - 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 22 07 40

**SECTION 22 08 10
VIBRATION ISOLATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies vibration isolation products and includes general description and installation methods.
- B. Vibration isolation products furnished as an integral part of factory fabricated equipment are specified as part of the equipment in other sections of Division 22.
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all vibration isolation work described in this Section.

1.03 QUALITY ASSURANCE

- A. Except as otherwise indicated; obtain vibration isolation products from a single manufacturer.
- B. Engage manufacturer to provide proper selection and technical supervision of installation of vibration control products.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide isolators as manufactured by one of the following:
 - 1. Amber Booth
 - 2. Consolidated Kinetics Corp.
 - 3. Flex-Hose Co.
 - 4. Keflex
 - 5. Korfund Dynamics Corp.
 - 6. Mason Industries, Inc.
 - 7. Metraflex
 - 8. Peabody
 - 9. Twin City Hose, Inc.
 - 10. Vibration Eliminator Co.

2.02 GENERAL

- A. Furnish and install vibration isolating mountings to isolate from the structure, by means of resilient vibration and noise isolators, all equipment having rotating or reciprocating parts. Isolators shall be supplied by a single source, and shall be guaranteed by the manufacturer to provide isolation efficiencies in accordance with this specification. Selection shall be based on equipment proposed, power dissipated, frequency, weight distribution and nature of the building structure.
- B. Selection of the mountings shall be made of the manufacturer to provide a transmissibility not exceeding 10%.
- C. Vibration of noise created in any part of the building by the operation of any equipment furnished and/or installed under this Contract shall be prohibited, and this Contractor shall take all precautions by isolating the various items of equipment, pipe and sheet metal work from the building structure. The major items of equipment shall be isolated as called for on the plans and specified herein. The minor items shall be held the responsibility of this Contractor.
- D. Vibration isolators shall have either known undeflected heights or their markings so, after adjustment, when carrying their full load, the deflection under load can be verified, this determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided.
- E. Size vibration isolators to operate in the linear portion of their load versus deflection curve. Furnish load versus deflection curves (linear over a deflection range 50 percent above the design deflection).
- F. The ratio of lateral to vertical stiffness of vibration isolators shall not be less than 1.0 or greater than 2.0.
- G. The vertical natural frequency for each support point based upon the load per isolator and isolator stiffness shall not differ by more than plus or minus 10 percent.
- H. Shore hardness of neoprene mountings: 40 to 60 after minimum aging of 20 days or corresponding overaging.
- I. Design or treat all isolators for resistance to corrosion. Structural steel bases shall be cleaned of welding slag and painted with a coat of red lead primer for interior use, and hot dip galvanized after fabrication for exterior use. All nuts, bolts and washers shall be zinc electroplated for interior use and hot dip galvanized for exterior use.
- J. Select all mounts to perform their function without undue stress or overloading. All isolators that are to be used with structural steel bases shall be equipped with height saving brackets. The bottom of the brackets shall be 1-1/2 inches above the floor. Furnish isolators with a method of leveling and where spring isolators are used, provide gussets on both sides of the isolators or other structural reinforcement as required to prevent distortion.
- K. Construct all structural steel bases with a minimum of four points of support. Structural steel bases: coped and fitted or constructed using the overlap insert method. Operating clearance of steel bases: at least 1-1/2 inches above the floor or housekeeping pad, clearance not to exceed 2-1/2 inches.

2.03 EQUIPMENT ISOLATION

- A. Isolate in-line pump support rods from building structure with rubber grommet type isolators. Install braided hose flexible connectors on inlet and discharge side of in-line pumps. Braided flexible hose connectors shall be constructed of stainless steel hose covered with stainless steel wire braid with NPT steel nipples or 150 psig ANSI flanges, welded to hose. Connectors shall be as manufactured by Flex-Hose Co., Metraflex or Twin City Hose.
- B. Isolate each base mounted pump and compressor from the piping systems by use of pipe-size neoprene or EDPM ("rubber") type flexible connector couplings constructed of multiple piles of nylon and bias-ply tire cord reinforcing fabric with Control Cable and 150 psig ANSI steel flanges.

- C. Install braided hose flexible connectors on discharge side of air compressors. Braided flexible hose connectors shall be constructed of stainless steel hose covered with stainless steel wire braid with NPT steel nipples or 150 psig ANSI flanges, welded to hose. Connectors shall be as manufactured by Flex-Hose Co., Metraflex or Twin City Hose, Inc.
- D. All floor supported piping and pipe hangers in the Equipment rooms shall be mounted on steel spring vibration isolators in combination with precompressed molded fiberglass noise isolators, designed for minimum static deflections of 1".

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which vibration control units are to be installed. Do not proceed with work until satisfactory conditions have been corrected in manner acceptable to installer.

3.02 PERFORMANCE OF ISOLATORS

- A. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

3.03 INSTALLATION

- A. General: except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration control materials and units. Adjust to ensure that units have equal deflection, no not bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices intended for temporary support during installation.
- B. Adjust leveling devices as required to distributed loading uniformly onto isolators. Shim units as required where substrate in not level.

END OF SECTION 22 08 10

**SECTION 22 10 10
COMMON PIPING REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Specifications of this Division complement the requirements of this Section.
- C. For general Codes and Standards requirements refer to Section 22 00 20.
- D. See other Division 22 Sections for medical gas system piping requirements.
- E. See other Division 22 Sections for high purity water system piping requirements.
- F. See other Division 22 Sections for acid waster and vent system piping requirements.

1.02 SCOPE

- A. This Section specifies piping materials and installation methods common to more than one section of Division 22 and includes fittings, joining methods, and basic piping installation instructions.
- B. Not all pipe materials and joining methods listed in this section pertain to this project. See specific system specification sections within this Division for approved materials and installation methods allowed to be used on this project.**
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. Compliance: Furnish and install plumbing system piping in accordance with regulations required by local the local authority having jurisdiction.
- B. Water Department/Local Authority Compliance: Furnish and install plumbing system piping in accordance with regulations required by local Water Department, and local authority having jurisdiction.
- C. All plumbing piping systems shall be installed in accordance with the applicable Plumbing Code.
- D. Domestic water piping for service line, meter setting and up to building reducing pressure backflow preventer shall be of materials approved by the Water Department having jurisdiction. See also Section 22 10 31.
- E. Comply with ANSI/NSF Standard 61 Drinking Water System Components – Health Effects.
- F. All natural gas systems shall be installed in accordance with the Local Mechanical Code and all requirements of the local authorities having jurisdiction.
- G. All natural gas systems shall comply with the latest "International Fuel Gas Code", and local utility requirements.
- H. ASHRAE: Comply with the ASHRAE Equipment Handbook, Chapter 6, for Chimney, Gas Vent, and Fireplace Systems, material requirements and design criteria.
- I. National Fuel Gas Code: Comply with National Fuel Gas code for gas pipe installation.

1.04 DEFINITIONS

- A. DWV: Drain, Waste and Vent
- B. EPDM: Ethylene Propylene Diene Monomer
- C. NPS: Nominal pipe size

PART 2 PRODUCTS

2.01 GENERAL

- A. Piping Materials:
 - 1. **Refer to individual system specification for allowable locations for each piping material, fitting style, and joining method. The following materials and joining may not be acceptable for certain projects and in certain areas.**
 - 2. Provide pipe of type, joint type, grade, size and weight (wall thickness or class) as is indicated for each service in other Division 22 sections of this specification.
 - 3. Where type, grade or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards

- B. Pipe Fittings:
 - 1. Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size.
 - 2. Provide sizes and types of matching pipe for valve or equipment connections in each case.
 - 3. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

- C. Joining Materials
 - 1. Soldering Materials: Surface to be soldered shall be cleaned, properly fluxed and soldered with 95-5 tin-antimony solder. 50-50 and all other lead-bearing solders are prohibited.
 - 2. Gaskets For Flanged Joints: Select materials and types to suit the service of the piping system in which they are installed. Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.
 - 3. Gaskets For Mechanical Couplings: Select materials to suit the service of the piping system in which they are installed. Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.02 COPPER PIPE AND FITTINGS

- A. Type K Soft Copper: ASTM B 88 water tube, annealed temper
- B. Type L Hard Copper: ASTM B 88 water tube, drawn temper
- C. Type ACR Hard Drawn Seamless Copper Tube: ASTM B 819
- D. Copper, Solder-Joint Fittings:
 - 1. ASME B16.22, wrought-copper, solder-joint pressure type.

- E. Copper, Pressure-Seal Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart
 - b. Nibco
 - c. Viega; Plumbing & Heating Systems.
 - 2. NPS 2 and Smaller:
 - a. Wrought-copper fitting with EPDM O-ring seal in each end.

3. NPS 2-1/2 to NPS 4
 - a. Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- F. Copper, Grooved-Joint:
1. Manufacturers: available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International.
 - b.
 - c. Victaulic Company.
 2. Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
 3. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.03 CAST-IRON PIPE AND FITTINGS

- A. No-Hub Cast Iron Pipe: ASTM A 888 or CISPI 301.
- B. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings
 1. Pipe and Fittings: ASTM A 74, Service class.
 2. Gaskets: ASTM C 564, rubber.
 3. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.
- C. Hubless (No-Hub) Cast-Iron Soil Pipe and Fittings
 1. Pipe and Fittings: ASTM A 888 or CISPI 301.
 2. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
 3. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - 1). Acceptable Manufacturers:
 - a). ANACO
 - b). Fernco, Inc.
 - c). Ideal Div.; Stant Corp.
 - d). Mission Rubber Co.
 - e). Tyler Pipe; Soil Pipe Div.
 - 2). Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a). Acceptable Manufacturers:
 - i. ANACO
 - ii. Clamp-All Corp.
 - iii. Ideal Div.; Stant Corp.

- iv. Mission Rubber Co.
 - v. Tyler Pipe; Soil Pipe Div.
4. No-Hub Cast Iron Fittings: Comply with ASTM A 888 or CISPI 301.
 5. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - a. Manufacturers:
 - 1). Dallas Specialty & Mfg. Co.
 - 2). Fernco, Inc.
 - 3). Logan Clay Products Company (The).
 - 4). Mission Rubber Co.
 - 5). NDS, Inc.
 - 6). Plastic Oddities, Inc.
 - b. Sleeve Materials:
 - 1). For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2). For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3). For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 6. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - a. Manufacturers:
 - 1). Cascade Waterworks Mfg. Co.
 - 2). Mission Rubber Co.

2.04 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Mechanical-Joint, Ductile-Iron fittings: AWWA C110, ductile – or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile – or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile-or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.

2.05 BLACK STEEL PIPE AND FITTINGS

- A. Black Steel: ASTM A53 Type E, Grade B.
- B. Black Steel, Threaded:
 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, seamless steel pipe.

2. Malleable-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- C. Black Steel, Welded:
1. Welded joints shall be provided for piping 2-1/2" and larger.
 2. Schedule 40 Factory Formed, Conforming with ASME B16.
 3. Flanges: ASME B16.1, Class 125, cast iron.
- D. Flexible Gas Pipe Connectors
1. Acceptable Manufacturers: Subject to compliance with requirements, provide flexible gas pipe connectors as manufactured by one of the following:
 - a. Flexicraft
 - b. Hyspan Precision Products, Inc.
 - c. Keflex, Inc.
 - d. Mason Industries
 - e. Metraflex
- E. Provide flexible gas piping connections constructed of stainless steel hose covered with stainless steel wire braid with carbon steel MPT nipples rated at minimum 150 psig working at 70°F.

2.06 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe: ASTM A 53, Type E, Grade B
- B. Galvanized-Steel, Grooved-Joint:
1. Manufacturers: available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International.
 - b. Victaulic Company.
 2. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 3. Grooved-End-Pipe Couplings for Galvanized-Steel Piping: AWWA C606 for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.07 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D 2665, solid wall, drain, waste, and vent
- B. Schedule 40 solid wall, conforming to ASTM D 1784 for drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.08 CPVC PIPE AND FITTINGS

- A. CPVC Pipe: ASTM F 441
- B. Schedule 40 solid wall, conforming to ASTM D 1784 for drain, waste, and vent.
- C. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.

2.09 POLYETHYLENE (PP) PLASTIC PIPE OR TUBING AND FITTINGS

- A. PE pipe and tubing: ASTM D 2239; ASTM D 3035; CSA B137.1; ASTM D 2737
- B. PE fittings: Heat fusion welded – ASTM D 2609; ASTM D 2683; ASTM D 3261; ASTM F 1055; CSA B137.1

2.10 POLYPROPYLENE (PP) PLASTIC PIPE OR TUBING AND FITTINGS

- A. PP pipe or tubing: ASTM F 2389; CSA B137.11
- B. PP fittings: ASTM F 2389; CSA B137.11

2.11 STAINLESS STEEL PIPE (TYPE 304/304L) AND FITTINGS

- A. Stainless steel pipe and fittings: ASTM A 312; ASTM A 778

2.12 PEX PIPE AND FITTINGS

- A. PEX Distribution System: ASTM F 877, SDR 9 tubing.
- B. PEX, Plastic Coupling:

2.13 JOINING MATERIALS

- A. Soldering Materials: Surfaces to be soldered shall be cleaned, properly fluxed and soldered with 95-5 tin-antimony solder. 50-50 and all other lead-bearing solders are prohibited.
- B. Gaskets For Flanged Joints: Select materials and types to suit the service of the piping system in which they are installed. Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.
- C. Gaskets For Mechanical Couplings: Select materials to suit the service of the piping system in which they are installed. Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.14 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Acceptable Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Acceptable Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Acceptable Manufacturers:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Acceptable Manufacturers:

- a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
- 1. Acceptable Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.15 DIELECTRIC TRANSITION FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, or flanged end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Flanges: Dielectric flanges shall include extended length high tensile studs (ASTM A193 GR.B7) with two (2) 1/16" thick mica isolating washers and two (2) nuts (ASTM A194 CR heavy series) on each side of flange, insulating bolt sleeve and raised face (Gylon 3540) insulation gasket.
- 1. Acceptable Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse
 - d. Epco Sales, Inc.
 - e. Perfection Corp.
 - f. Ricwil Piping Systems
 - g. Watts Industries, Inc.; Water Products Div.
- D. Dielectric Nipples: Electroplated galvanized steel or brass nipple with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- 1. Acceptable Manufacturers:
 - a. Epco Sales, Inc.
 - b. Grinnell
 - c. Perfection Corp.
 - d. Precision Plumbing Products, Inc.
 - e. Sioux Chief Manufacturing Co., Inc.
 - f. Victaulic Co. of America.

2.16 JOINING MATERIALS AND METHODS

- A. Grooved: Roll grooved joints per coupling manufacturer's specifications.
- B. Pressed: Pressed joints per manufacturer's recommendations, using tool designed and approved specifically for use with fittings.
- C. Threaded: Pipe threads shall conform to ASME B1.20.1.

- D. Welding: Comply with ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- E. 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 thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250 steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- F. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- G. Plastic, Pipe-Flange Gasket, Bolts, and Nuts:
 - 1. Type and material recommended by piping system manufacturer, unless otherwise indicated.
- H. Solder Filler Metals:
 - 1. ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813. 50-50 and all other lead-bearing solders are prohibited.
- I. Brazing Filler Metals:
 - 1. AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated
 - 2. AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- J. Welding Filler Metals:
 - 1. Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- K. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
 - 5. High Purity Water: System components shall be joined utilizing LE One-Step specialty solvent cement specifically formulated for joining the system that meet or exceed the requirements of ASTM D2564. The standard practice for safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement shall be listed by The National Sanitation Foundation International (NSF Intl.) for use with potable water.
- L. Heat Fusion Welding
 - 1. ASTM Standard F1056.
 - 2. PPI Standards TR-33 and TR-41.
 - 3. AWWA C901 and C906.
 - 4. Local gas company requirements.

2.17 UNIONS

- A. All unions shall be suitable for the temperature/pressure ratings and service in which installed. See each specific system description section of Division 22 for additional information.

Table 22 10 10.1

Pipe Material	Size	Description
Steel	2" and smaller	Malleable iron, threaded ends, ground joint brass to iron seat
	2-1/2" and larger	Weld-neck flange connections
Copper	2" and smaller	Cast brass solder ends, with machined and lapped seats
	2-1/2" and larger	Soldered-neck flange connections

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris and moisture.
- B. Protect Stored Pipes: Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor or structure.
- C. Protect flanges, fittings and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

3.02 SUPPORT

- A. Support piping independently so as not to place a strain on valves and equipment.
- B. See Section 22 12 20 - Piping Hangers and Supports for more details.

3.03 PIPING INSTALLATION

- A. The Drawings indicate the general location and arrangement of the piping systems. So far as practical, install piping as indicated making connections to all equipment. Install piping as direct as possible avoiding unnecessary offsets. However, if offsets are required in order to obtain maximum headroom or to avoid conflict with other work, they shall be made as required or as requested by the Engineer without additional cost to the Owner. The Engineer reserves the right to make minor changes in the location of piping and equipment during the roughing-in, without additional cost to the Owner. All changes proposed by others shall be approved by the Engineer.
- B. Install piping, requiring insulation, a sufficient distance from wall, ceiling, structure, other pipes, etc. to permit the application of the full thickness of insulation specified.
- C. Install piping free of sags or bends. Support piping independently so as not to place a strain on valves and equipment.
- D. Where piping is installed above accessible ceilings, allow sufficient space between ceiling and pipe to remove ceiling panels. Consideration must be given for insulation thickness.
- E. Locate piping installed parallel to each other with adequate space for servicing of valves where applicable.
- F. Any piping resting on or coming in contact with building structure shall be insulated at that point to prevent transmission of vibration.
- G. All piping systems must be installed so they can be completely drained. Provide tee fitting, ball valve with hose thread fitting and cap at all low points, trapped sections, bases of risers, and on equipment side of shut off valves to permit draining. All drain valves shall be accessible.
- H. All piping shall be installed parallel with, or at right angles to, the building walls. All vertical risers shall be installed plumb and straight. Diagonal runs are not permitted unless expressly indicated on the drawings.

- I. Install all piping with reduction in size being made only at the inlet or outlet of the control valve, reducing or regulating valve, equipment or fixture. All check valves, strainers, shut-off valves, etc. shall be installed full line size.
- J. Make reductions in piping with a reducing coupling or weld fitting reducer. Bushings are not permitted.
- K. Taps shall be provided as necessary to permit the installation of thermometers, pressure gauges, etc. Taps shall be similar to branch connections.
- L. Pipe relief valve discharges, etc. down to the floor or nearest floor drain where indicated. Drain piping shall terminate with a plain, unthreaded end.
- M. Install dielectric transition fittings between dissimilar metal pipes.
- N. Factory formed long radius elbows shall be utilized for all changes in direction. Mitering of pipe to form elbows is not permitted. Pipe bending is not acceptable.
- O. Make branch connections in threaded or soldered piping with factory formed fittings. Notching of straight runs of pipe to form tee connections is not permitted.
- P. Install appropriate dielectric transition fittings between piping of different materials.
- Q. Bullhead connections in any piping system are prohibited.
- R. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- S. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

3.04 JOINTS

- A. After cutting, ream ends of piping and remove all burrs. Remove all scale, slag dirt and debris from both inside and outside of piping and fittings before assembly. Swab if necessary for thorough cleaning.
- B. Pipe to be threaded shall be cut square and fully threaded with tapering threads. Apply pipe joint compound to male thread end of all threaded joints. Joint compound shall be compatible with the service of the piping.
- C. The edges of pipe to be welded shall be machine beveled wherever possible. Before welding, the surfaces shall be thoroughly cleaned. The piping shall be carefully aligned. No metal shall project within the pipe.
- D. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- E. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- F. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- G. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux, ASTM B 32, lead-free alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- H. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- I. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.05 EXPANSION

- A. Piping shall be cut accurately to measurement at the site and worked into place without springing or forcing. Sufficient offsets, expansion loops or expansion joints between anchor points shall be provided as required, whether or not shown, to limit stresses and control movement of piping subject to the thermal expansion.
- B. Make hot water branch connections from mains to fixtures and heating equipment with at least two (2) 90 degree elbows.

- C. Supplement all loops, joints, compensators, etc. with adequate guides to preserve alignment and pitch.
- D. Securely attach pipe guides to the building structure.
- E. Provide securely supported pipe anchors as required to control expansion and contraction in piping.

3.06 ESCUTCHEONS

- A. Fit all pipe passing exposed through walls, floors or ceilings in finished rooms with brass escutcheons. Include wall penetrations beneath lavatories and sinks, and beneath cabinets/counters. Where adjacent surface is to receive a paint finish, prime paint escutcheons, otherwise escutcheons shall be chrome plated. Where piping is insulated, fit escutcheons outside insulation.

3.07 CLEANING

- A. After piping installation is complete and before final connections to equipment are made, thoroughly flush the piping system with a material/detergent that is not injurious to the pipe, to remove all pipe dope, oils, welding slag, scale and other extraneous material.
- B. After flushing, clean all strainers, traps and dirt legs.
- C. See each specific system description section of Division 22 for additional cleaning requirements.

END OF SECTION 22 10 10

**SECTION 22 10 20
DRAIN, WASTE AND VENT PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping materials and installation methods common to more than one section of Division 22 and includes fittings, joining methods and basic piping installation instructions. Portions of this Section may not be required in this project. **Only the piping materials specified in this section shall be utilized for this project.** Similarly, other items in the Section might be superseded by more specific requirements in other sections that detail specific systems. See drawings and each specific system description section of Division 22 for specific sizes, materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all piping work described in this Section.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 GENERAL

- A. All piping shall be constructed of materials and joined together as indicated in the following table and as specified in the following sections:

2.02 PIPE AND FITTING TABLE

- A. The table below identifies the acceptable pipe materials, fitting types, and joint methods allowed for each pipe service and size. Where multiple options are listed, the option used shall be at the discretion of the Contractor.

Service	Size	Pipe Material	Fittings	Type of Joint
Above Ground Sanitary Drain, Waste, and Vent (includes pumped sanitary and storm)	All	Service Weight No Hub Cast Iron	Factory Formed Service Weight Cast Iron DWV fittings	Elastomeric sleeves with stainless steel clamps. Couplings shall comply with "CISPI 310". The elastomeric sealing sleeve shall conform to "ASTM C564" and shall be provided with a center stop.
		Schedule 40 PVC ONLY IN NON-AIR PLENUM SPACES – VERIFY PLUMBING CHASES	Factory formed schedule 40 PVC	PVC solvent cement

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. Installation shall conform to all requirements in "Common Piping Requirements" section of these Division 22 Specifications.
- B. Install all drain and vent lines as direct as possible. Actual locations shall meet the various building conditions and shall not conflict with ductwork or piping of other trades. Any work necessary to conceal piping shall be done as directed by the Architect.
- C. Branch soil and waste pipes shall have a slope or incline of at least 1/4" per foot of run and main house drain shall slope a minimum of 1/8" per foot. Storm drains shall slope at a minimum of 1/4" per foot, unless otherwise noted. Vent pipes, where not vertical shall have a continuous slope. Pipe shall grade downward in the direction indicated on drawings. All pipe lines shall be correctly aligned before joints are made. All changes of direction in drainage and vent piping shall be made by means of factory-formed "Y" branches and factory-formed 1/6, 1/8, or 1/16 bends. All horizontal vent piping shall be installed with a continuous slope toward the connection to the drain piping. Traps in the vent piping are not permitted.
- D. Make changes of direction in horizontal drain piping with bends of not more than 45°. Where change of direction is greater than 45°, install wye fitting with required bends and clean-out. Sanitary tees are not permitted in horizontal changes of direction. Avoid all unnecessary offsets.
- E. Sanitary tees are not permitted in vertical to horizontal changes of direction.
- F. Sanitary tees are permitted in horizontal to vertical changes of direction. Double sanitary tees are permitted in horizontal to vertical changes of direction except to receive the discharge of back-to-back water closets.
- G. Provide clean-outs at the base of all stacks and vertical storm leaders; at changes of direction in horizontal drain piping greater than 45° and as shown on the drawings. Provide clean-outs in horizontal straight runs of piping at intervals not over 50'. Install clean-outs wherever storm sewers and sanitary sewers exit the building.
- H. Clean-outs in concealed piping or piping below the floor shall be extended through and terminate flush with the finished floor above.
- I. Clean-outs shall be the same size as the pipe to which they are connected up to 4". Pipes larger than 4" shall have a 6" clean-out. Install all clean outs with required clearance for rodding.
- J. Provide drainage piping for all plumbing equipment requiring drainage. This shall include drain piping from ice machines. Insulate drainage pipe with flexible elastomeric insulation.
- K. Unless noted otherwise, provide all floor drains with traps.
- L. Vent terminals shall be terminated at least 12 inches above roof. Each PVC or ABS vent terminal shall be made water tight with the roof by using a rubber boot with base not less than 16" diameter and collar full height of pipe. Each steel pipe vent terminal shall be made water tight with the roof by using lead sheet (3 lb. psf) or sheet copper (8 oz. psf) with base not less than 16" diameter and collar full height of pipe. Where vents are 4" or larger, flashing may be turned over into top of pipe without gap. Furnish boot or flashing to General Contractor for building into roofing material.

- M. Underground storm and sanitary sewers shall be laid with full length of each section resting on a solid bed. Where necessary to obtain a firm support, the pipe shall be bedded on select material and thoroughly tamped. Pipe shall be laid starting at the up grade and spigot end of Bell and Spigot pipe pointing in the direction of flow. As pipe is laid, care shall be exercised to keep interior of pipe clear of foreign matter. Where trenching for pipe is excessively wide, the Contractor shall, at his own expense, embed the pipe in concrete to support the added load of backfilling.
- N. All excavations for installation of pipe shall be open trench work and shall be kept open until piping has been inspected, tested, and accepted.
- O. Any metal piping laid in corrosive fill shall be encased in concrete or in split tile. All sewers greater than 14 feet below finish grade shall be encased in concrete.
- P. Install buried piping inside the building between wall and floor penetrations and connections to sanitary sewer piping outside the building with restraint joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- Q. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- R. Install CPVC and PVC soil and waste drainage and vent piping according to ASTM D 2665.
- S. Install underground CPVC and PVC soil and waste drainage piping according to ASTM D 2321.

3.02 JOINTS

- A. After cutting, ream ends of piping and remove all burrs. Remove all scale, slag dirt and debris from both inside and outside of piping and fittings before assembly. Swab if necessary for thorough cleaning.
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Hubless (No-hub) cast iron joint couplings shall comply with "CISPI 310". The elastomeric sealing sleeve shall conform to "ASTM C564" and shall be provided with a center stop. Mechanical joint couplings shall be installed in accordance with the manufacturer's installation instructions.

3.03 CLEANING

- A. After piping installation is complete and before final connections to equipment and fixtures are made, thoroughly flush the piping system with a material/detergent that is not injurious to the pipe, to remove all shavings, pipe dope, oils, welding slag, scale and other extraneous material.

3.04 TESTING

- A. All plumbing piping systems specified herein shall be air tested or hydrostatically tested per the "Piping Systems Integrity Verification" section of Division 22 Specifications.

END OF SECTION 22 10 20

**SECTION 22 10 30
DOMESTIC WATER PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.
- C. Refer to Section 22 10 10 for Common Piping Requirements.

1.02 SCOPE

- A. This Section specifies piping materials and installation methods for domestic water system piping and includes fittings, joining methods and specific piping installation instructions. **Only the piping materials specified in this section shall be utilized for this project.**
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all piping work described in this Section.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 GENERAL

- A. All piping shall be constructed of materials and joined together as specified in the following sections.

2.02 PIPE AND FITTING TABLE

- A. The table below identifies the acceptable pipe materials, fitting types, and joint methods allowed for each pipe service and size. Where multiple options are listed, the option used shall be at the discretion of the Contractor.

Table 22 10 30.1

Service	Size	Pipe Material	Fittings	Joint Method*
Domestic Water Inside the Building (Cold, Hot, and Hot Re-circulated)	4" and smaller	Type L Hard Copper	Wrought Copper Factory Formed	S
	4" and smaller	Type L Hard Copper	Wrought Copper Factory Formed	P
	6" and larger	Schedule 40 galvanized	Galvanized	G
	6" and larger	Schedule 10 Stainless Steel	Stainless Steel	G
Drain Piping and Trap Primer (Above Ground)	All sizes	Type L Hard Copper	Wrought Copper Factory Formed	S
	All sizes	Cross-linked Polyethylene (PEX)	Not Allowed	Not Allowed

*Joint Methods: G=Grooved, P=Pressed, S=Soldered

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall conform to Section 22 10 10 - Common Piping Requirements.
- B. All piping systems must be installed so they can be completely drained. Provide tee fitting, ball valve with hose thread fitting and cap at all low points, trapped sections, bases of risers, and on equipment side of shut off valves to permit draining. All drain valves shall be accessible. All piping shall be installed parallel with, or at right angles to, the building walls. All vertical risers shall be installed plumb and straight. Diagonal runs are not permitted unless expressly indicated on the drawings.
- C. Install all piping with reduction in size being made only at the inlet or outlet of the control valve, reducing or regulating valve, equipment or fixture. All check valves, strainers, shut-off valves, etc. shall be installed full line size.
- D. Make reductions in piping with a reducing coupling or soldered weld fitting reducer. Bushings are not permitted.
- E. Factory formed long radius elbows shall be utilized for all changes in direction. Mitering of pipe to form elbows is not permitted. Pipe bending is not acceptable.
- F. Make branch connections in threaded or soldered piping with factory formed fittings.
- G. Taps shall be provided as necessary to permit the installation of thermometers, pressure gauges, etc. Taps shall be similar to branch connections.
- H. Pipe relief valve discharges, etc. down to the floor or nearest floor drain where indicated. Drain piping shall terminate with a plain, unthreaded end.
- I. Install appropriate dielectric transition fittings between piping of different materials.
- J. Bullhead connections in any piping system are prohibited.
- K. "Dead-Legs" in any piping system are prohibited.
- L. Unless noted otherwise, make final water connections to all plumbing fixtures and equipment. This shall include coffee makers, refrigerators, ice machines, washers, etc.

3.02 EXPANSION

- A. Piping shall be cut accurately to measurement at the site and worked into place without springing or forcing. Sufficient offsets, expansion loops or expansion joints between anchor points shall be provided as required, whether or not shown, to limit stresses and control movement of piping subject to the thermal expansion. Allow 1-1/4" per 100 feet of length for expansion in domestic hot water lines.
- B. Make branch connections to domestic hot water risers with at least two (2) 90 degree elbows.
- C. Supplement all loops, joints, compensators, etc. with adequate guides to preserve alignment and pitch.
- D. Securely attach pipe guides to the building structure.
- E. Provide securely supported pipe anchors as required to control expansion and contraction in piping.

3.03 CLEANING

- A. After piping installation is complete and before final connections to equipment and fixtures are made, thoroughly flush the piping system with a material/detergent that is not injurious to the pipe, to remove all pipe dope, oils, slag, scale and other extraneous material.
- B. After flushing, clean all strainers.
- C. See each specific system description section of Division 22 for additional cleaning and disinfection requirements.

3.04 TESTS

- A. All plumbing piping systems specified herein shall be hydrostatically tested per Section 22 03 10 "Piping Systems Flushing and Testing."

3.05 DISINFECTION

- A. All plumbing piping systems specified herein shall be disinfected per Section 22 03 10 "Piping Systems Flushing and Testing."

END OF SECTION 22 10 30

**SECTION 22 10 31
WATER SERVICE PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.
- C. Refer to Section 22 10 10 for Common Piping Requirements.

1.02 SCOPE

- A. Water service supply responsibility is limited to 5'-0" from building line and into the building refer to site/civil engineering drawings for coordination of scope. New separate domestic water and fire main services are required for the project. Coordinate these services with the site work contractor.
- B. This Section specifies piping materials and installation methods for water service piping and includes fittings, joining methods and specific piping installation instructions.
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all piping work described in this Section.
- D. See drawings and each specific system description indicated herein for specific sizes, materials and installation methods pertaining to this project. Portions of this Section may not be required for this project.
- E. Water service piping shall be defined as all piping from the source main up to the facility's main backflow prevention device. This includes piping around meter setting.
- F. The Contractor is responsible for obtaining all permits, paying all fees, and following all requirements associated with the permits.
- G. The Contractor shall be responsible for notifying the Ohio Utility Protection Service (OUPS) as required by law.

1.03 CODES AND STANDARDS

- A. Water Department/Fire Department/Marshal Compliance:
 - 1. Furnish and install water service piping systems in accordance with regulations required by the local Water Department, local Building Department and local Fire Departments.
- B. All on-site water line piping and appurtenances shall be installed according to the local Water Department specifications and must be inspected and approved by the Greater Cincinnati Water Works.

1.04 SUBMITTALS

- A. Shop Drawings: Provide Shop Drawings, per requirements of Sections 22 01 10 and 22 01 20.
- B. Operation and Maintenance (O&M) Manuals: Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 GENERAL

- A. All piping shall be constructed of materials and joined together as specified in the following sections.

2.02 PIPE AND FITTING TABLE

- A. The table below identifies the acceptable pipe materials, fitting types, and joint methods allowed for each pipe service and size. Confirm pipe and fitting type and joint method with the Greater Cincinnati Water Works requirements.

- B. Pipe schedules refer to ANSI B36.
- C. Pipe sizes refer to Nominal Pipe Sizing (NPS) standards.

Table 22 10 31.1

Service	Size	Pipe Material	Fittings	Joint Method*
Water Service	2" and smaller	Type K Copper	Wrought Copper Factory Formed	F
	2-1/2" and larger	AWWA C151 Class 53 ductile iron with ANSI/AWWA C104/A21.4 cement lining. Provide labeled polyethylene encasement per AWWA C105.	Class 350 ductile iron compact fittings per AWWA C153 or full thickness castings per AWWA C110, with mechanical joint ends and ductile iron follower glands.	PO

*Joint Methods: F=Flared, PO=Push-On

PART 3 EXECUTION

3.01 PIPING INSTALLATION

- A. Refer to Division 22 Section "Common Piping Requirements" for basic piping installation.
- B. All underground pipe shall be installed with 4 feet 6 inches of cover. See detailed water department specifications for approved pipe, fittings, bolts, etc., for water line installation.
- C. Maintain a 12 inch minimum vertical clearance from edge of water line to edge of storm sewers and/or inlet lead where they cross.
- D. Maintain a 4 foot minimum horizontal clearance from edge of water line to edge of storm sewer.
- E. Maintain a 10 foot horizontal clearance from edge of water line to edge of sanitary sewer.
- F. Maintain an 18 inch minimum vertical clearance from edge of water line to edge of sanitary sewer where they cross.
- G. Maintain a 12 inch vertical clearance from edge of water line to edge of gas, electric, etc.
- H. Maintain a 5 foot minimum horizontal clearance from edge of water line to edge of gas lines(s), electric line(s), communication line (s), etc.
- I. In buildings with interior meter setting without basements, water service line must be installed in an AWW approved conduit from one foot outside footer to above floor slab.
- J. Buildings with interior meter settings not on outside wall, the water service line must be installed in a continuous AWW approved conduit from outside building footer up through floor slab.
- K. Water service line installed under paved areas for inside meter setting must be in an AWW approved conduit from street right-of-way to inside building.

3.02 TESTING

- A. Piping systems specified herein shall be tested per the "Piping Systems Integrity Verification" section of Division 22 Specifications.

3.03 CLEANING AND PURGING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water /chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
4. Prepare reports of purging and disinfecting activities.

3.04 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trenches for underground water-distribution piping. Locate below finished grade, directly over piping.
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel.

END OF SECTION 22 10 31

**SECTION 22 10 40
NATURAL GAS PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.
- C. Refer to Section 22 10 10 for Common Piping Requirements.

1.02 SCOPE

- A. This Section specifies piping for natural gas systems installed inside or outside above grade and outside below grade, and includes materials, testing and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 PIPE AND FITTING TABLE

- A. The table below identifies the acceptable pipe materials, fitting types, and joint methods allowed for each pipe service and size. Where multiple options are listed, the option used shall be at the discretion of the Contractor.
- B. Pipe schedules refer to ANSI B36.
- C. Pipe sizes refer to Nominal Pipe Sizing (NPS) standards.

Table 22 10 40.1

Service	Size	Pipe Material	Fittings	Joint Method*
Interior and Exterior Above-Ground	2" and smaller	Schedule 40 Black Steel	150 psig, working pressure, malleable iron, screwed type	T
	2-1/2" and larger	Schedule 40 Black Steel	Factory formed welding fittings	W
Gas Vent	2" and smaller	Schedule 40 Black Steel	150 psig, working pressure, malleable iron, screwed type	T
	2-1/2" and larger	Schedule 40 Black Steel	Factory formed welding fittings	W
Gas Vent	2" and smaller	Type "L" Hard Copper	Factory formed fittings	S
	2-1/2" and larger	Type "L" Hard Copper	Factory formed fittings	S

*Joint Methods: T=Threaded, W=Welded, S=Soldered

PART 3 EXECUTION

3.01 GENERAL

- A. Install at piping as shown on the drawings with connections made to all equipment as indicated.

- B. Provide a line size shut-off valve, union and tee with full sized dirt leg (sediment trap) at all equipment connections. Reduce pipe size only at equipment connection. Lubricate all valves before putting the valves into service.
- C. Piping shall not be installed through ductwork, laundry or clothes chutes, elevator shafts, and chimneys.
- D. Piping shall not be installed in solid partition walls unless a chase or casing is provided.
- E. Portions of gas piping systems installed in concealed locations (i.e., inside stud walls or above drywall ceiling) or within return air ceiling plenums, shall not contain unions or shut-off valves. All gas valves shall be accessible. Elbows, tees and couplings are permitted.
- F. Gas piping shall not be used as a grounding electrode.
- G. Bushings shall not be utilized.
- H. Cast iron fittings shall not be utilized.
- I. Galvanized pipe or fittings shall not be utilized.
- J. Provide ½" elastomeric insulation around all piping in walls and through floors.
- K. Provide taps as necessary for installation of pressure gauges.
- L. Extend gas vent piping through an exterior wall, elbow downward, increase open pipe discharge two pipe sizes larger than vent size, and cover open discharge pipe with a stainless steel insect screen.
- M. Provide yellow insulated, continuous underground 12 gauge copper tracer wire to mark underground gas pipe. Provide tracer wire directory overtop of underground non-metallic pipe. Tracer wire shall not be wrapped around plastic pipe. Tracer wire shall terminate above ground at wall bracket. Include identification tape: yellow with black lettering "Natural Gas".
- N. All black steel pipe and fittings exposed to the outdoors shall be painted with primer, and then two coats of rust inhibited paint-color as selected by the Architect.

3.02 INSPECTION, TESTING, AND PURGING

- A. All gas piping systems shall be inspected and pressure tested. Testing procedure shall conform to the local gas utility requirements and the latest "International Fuel Gas Code".
- B. Test pressure shall be 1-1/2 times the proposed maximum working pressure, but not less than 3 psi, irrespective of design pressure. Test medium shall be air or an inert gas (OXYGEN SHALL NEVER BE USED). Test duration shall be 24 hours. Prior to testing, the interior of the pipe shall be cleared of all foreign material.
- C. All testing shall be done with due regard for the safety of employees and the public.
- D. After a successful pressure test and before the system is placed in operation, the piping system shall be purged in accordance with NFPA 54 "National Fuel Gas Code". The point of discharge shall not be left unattended during purging. After the piping has been placed in operation, all equipment shall be purged and then placed in operation, as necessary.

END OF SECTION 22 10 40

**SECTION 22 11 10
PIPING INSULATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies insulation materials and installation methods common to more than one section of Division 22.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all insulation work described in this Section.

1.03 QUALITY ASSURANCE

- A. Installing contractor shall have at least 3 years successful installation experience on projects with mechanical insulation similar to that required for this project.
- B. Insulation thickness shall meet the minimum requirements of ASHRAE Standard 90.1.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.
- C. Replace damaged insulation which cannot be satisfactory repaired, including insulating with vapor barrier damaged and moisture-saturated insulation.
- D. The insulation installer shall advise the General Contractor as to requirements for protection of the insulation work during the remainder of the construction period (after the installation of insulation), to avoid damage and deterioration of the finished insulation work.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Unless otherwise noted, and subject to compliance with Specifications, provide insulation materials from the manufacturers specified below:
 - 1. Fiberglass Pipe Insulation
 - a. Owens Corning
 - b. Knauf
 - c. CertainTeed
 - d. Johns Manville
 - 2. Closed Cell Elastomeric Insulation
 - a. Insul-Tube
 - b. K-Flex USA

- c. Manson Insulation
- d. Nomaco Kflex
- e. Techlite Insulation
- f. Thermacel

2.02 GENERAL

- A. Provide all insulation materials (insulation, jackets, fitting covers, adhesives, cements, mastics, sealers and finishes) with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

2.03 FIBERGLASS

- A. Provide one-piece fiberglass pipe insulation with all-service jacket for all piping systems indicated on drawings or in other sections of this Specification.
- B. Fiberglass pipe insulation shall have a "k" factor of 0.23 at a mean temperature of 75 °F.
- C. Fiberglass pipe insulation shall comply with ASTM C 547 Type I.
- D. Factory applied all service jacket shall be white, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
- E. Apply the following fiberglass insulation thicknesses to the pipe sizes schedule:

Table 22 11 10 .1 – Fiberglass Pipe Insulation Thickness

Pipe Type	Pipe Size				
	0 to 1"	1-1/4" to 2"	2-1/2" to 4"	5" and 6"	8" and above
Domestic Cold Water Piping	1"	1"	1"	1"	1"
Domestic Hot Water Piping	1"	1"	1-1/2"	1-1/2"	1-1/2"
Horizontal Storm Conductors	1"	1"	1"	1"	1"

2.04 CLOSED CELL ELASTOMERIC INSULATION

- A. Provide closed-cell elastomeric pipe insulation for all piping systems indicated on drawings or in other sections of this Specification.
- B. Closed cell elastomeric pipe insulation shall comply with ASTM C 534 Type I.
- C. Apply the following closed cell elastomeric insulation thicknesses to the pipe sizes scheduled:

Table 22 11 10 .2 - Closed Cell Elastomeric Insulation Thickness

Pipe Type	Pipe Size				
	0 to 1"	1-1/4" to 2"	2-1/2" to 4"	5" and 6"	8" and above
Water Cooler traps and wastes (if not factory insulated)	1/2"	1/2"	1/2"	1/2"	1/2"
Trap primer piping – above and below floor	1/2"	1/2"	1/2"	1/2"	1/2"
Domestic Water Piping - Below Floor	1/2"	1/2"	1/2"	1/2"	1/2"

Pipe Type	Pipe Size				
	0 to 1"	1-1/4" to 2"	2-1/2" to 4"	5" and 6"	8" and above
Floor drains, traps of floor drains, and horizontal sanitary piping receiving cooling coil condensate drainage or ice machine drainage (closed cell elastomeric sheet insulation)	1"	1"	1"	1"	1"
Domestic Cold Water Piping	1"	1"	1"	1"	1"
Domestic Hot Water Piping	1"	1"	1-1/2"	1-1/2"	1-1/2"
Horizontal Storm Conductors	1"	1"	1"	1"	1"

2.05 PVC JACKETS

- A. PVC jacket shall be high-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C.
- B. Provide PVC jacket on all exposed piping required to receive insulation (piping below finished ceiling; not concealed above ceilings or within walls).

2.06 ALUMINUM JACKETS

- A. Jacket shall be 0.016" thick sheet aluminum.

2.07 ADA INSULATION KITS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide insulation kits as manufactured by one of the following:
 1. McGuire Manufacturing Company, Inc. "ProWrap"
 2. Truebro "Handi Lav-Guard"
 3. Plumberex "Pro-2000" series
- B. Materials
 1. Insulation kits shall be a minimum of 1/8" thick molded closed cell vinyl construction with PVC satin white cover. Insulation material shall be anti-microbial/anti-fungal. Provide kit with removable valve access caps.
 2. Units shall be barrier-free, and shall be installed per ADA requirements and shall comply with ICC/ANSI A 117.1.

PART 3 EXECUTION

3.01 GENERAL

- A. Install insulation products according to manufacturer's printed instructions, in compliance with recognized industry standards and this specification.
- B. Install all insulation over clean, dry surfaces. Insulation must be dry and in good condition. Wet or damaged insulation is not acceptable.
- C. Install all insulation only after the completion of system pressure tests and leakage tests and installation of piping heat trace.
- D. Install insulation materials with smooth even surfaces. Use full lengths of insulation where possible, only cut where necessary. Do not use cut pieces or scraps abutting each other.
- E. Repair existing pipe and equipment insulation where removed to make new connections, to add controls, or where damaged by new construction. Use same insulation as specified for new service.

- F. Where existing asbestos insulation is discovered or suspected – notify the building Owner immediately so it can be removed under a separate asbestos removal contract.

3.02 PIPING INSULATION

- A. On exposed piping, locate insulation and cover seams in least visible locations.
- B. Install piping insulation continuous through all wall, floor and ceiling penetrations, sleeves and pipe hanger locations.
- C. Install fiberglass pipe insulation with joints butted firmly together. Seal jacket laps with butt strips, having factory applied adhesives. **Insulate all valves and fittings using mitered sections of insulation or premolded fitting insulation.** Cover valves and fittings with the same type and density of insulation as used on the piping. Do not cover valve bonnets, unions and strainers with insulation except for domestic cold water piping systems.
- D. Taper all fiberglass insulation ends, seal and cover with glass cloth regardless of service. Where vapor barrier jackets are used on cold surfaces, apply insulation with vapor seal integrity maintained throughout the entire system. Staples shall not be used on any cold piping systems.
- E. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping, apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.
- F. Apply the manufacturer's recommended adhesive for closed-cell elastomeric pipe and sheet insulation based on the working temperature of service.

3.03 ADA INSULATION KITS

- A. Install on all exposed hot water, cold water and drain piping under wall mounted plumbing fixtures.

3.04 PROTECTION

- A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.
- B. The insulation installer shall advise the General and Plumbing Contractors as to requirements for protection of the insulation work during the remainder of the construction period (after the installation of insulation), to avoid damage and deterioration of the finished insulation work.

END OF SECTION 22 11 10

**SECTION 22 12 10
PIPING IDENTIFICATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies mechanical system piping identification and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All pipe markers shall conform to ANSI A13.1 – 1996 "Scheme for the Identification of Piping Systems".

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.
- C. Schedules: Submit valve schedule for each piping system. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space) and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses by special "flags" in margin of schedule. After review and approval of valve schedule, furnish extra laminated copies for Maintenance Manuals as specified in Division 1. Valve numbering sequence shall follow the format of the Owner's existing system.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide identification products as manufactured by one of the following:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc.
 - 3. Craftmark Identification Systems.
 - 4. DuraLabel/Graphic Products
 - 5. Identification Depot
 - 6. Kolbi Pipe Marker Co.
 - 7. Marking Services, Inc.
 - 8. Seton Identification Products.

2.02 PIPE MARKERS

- A. Colored, precoiled plastic, designed to install without the need for tape or a band. Markers to include flow direction arrows and lettering describing pipe's contents. Markers shall provide 360° visibility.

- B. Markers for installation on piping with outside diameter less than 6" (including insulation) shall be snap-around type. Markers for installation on piping with outside diameter 6" or greater (including insulation) shall be strap-around type.
- C. Marker colors and wording for each specific piping system shall be as follows:

Table 22 12 10.1

Marker Wording	Background/Lettering
Domestic Cold Water	Green/White
Domestic Hot Recirculation	Yellow/Black
Domestic Hot Water (110°F)	Yellow/Black
Domestic Hot Water (140°F)	Yellow/Black
Natural Gas	Yellow/Black
Storm Sewer	Green/White

2.03 VALVE TAGS

- A. Brass valve tags, 1-1/2" diameter round with black fill letters and numbers. 19 gauge brass with 3/16" top hole.
- B. Valve tags shall have a 1/4" high "PLBG" label.
- C. Each system shall be consecutively numbered, starting with "1", with 1/2" high numbers.
- D. Valve tags shall be attached to each valve with a non-rusting ring or chain.

2.04 CEILING MARKERS

- A. Ceiling markers shall be provided for all shut off valves concealed above ceiling that serve more than six fixtures. Ceiling markers shall be 1" diameter white sticky tags with 1/4" green lettering abbreviated as follows:

Piping Valve Serves	Abbreviation – followed by valve tag number
Domestic Cold Water	DCW – xxx
Domestic Hot Water	DHW - xxx
Domestic Hot Water Recirc	RHW - xxx
Softened Cold Water	SCW - xxx

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated in coordination with the Owner or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of plumbing systems and equipment.

3.03 PIPE MARKER INSTALLATION

- A. General: Install pipe markers on each system indicated under piping identification schedule and include arrows to show normal direction of flow. Install on pipe insulation segment where required for hot non-insulated pipes.
- B. Install pipe markers at the following locations:
 - 1. Adjacent to valves.

2. Where pipes pass through walls, on both sides of wall.
3. Where pipes pass through floor, above floor, within two feet of floor level.
4. Near all branches and changes in direction.
5. At 20 foot intervals on straight runs of pipe.
6. At access door locations.

3.04 VALVE TAGS INSTALLATION

- A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude valves within factory-fabricated equipment units, shut off valves to individual plumbing fixture faucets, convenience and lawn-watering hose bibs and angle stops at plumbing fixtures and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
- B. All shut-off and balancing valves shall be tagged except local valves adjacent to an equipment item or fixture.
- C. At the completion of the project, provide a valve directory for each system. Include a copy of each directory in the Operating and Maintenance Manual. Coordinate the valve designation/numbering system with the Owner. Directory shall include valve designation/number, service, building location, size and equipment/fixtures controlled.
- D. Accurately record valve tag numbers and locations on the "Record Drawings".

3.05 CEILING MARKERS INSTALLATION

- A. Ceiling markers shall be in close proximity to the valve that it tags. Ceiling markers shall be installed on the tee bars of layin ceilings, but not on the main runs.

END OF SECTION 22 12 10

**SECTION 22 12 20
PIPING HANGERS AND SUPPORTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping hanging and supporting methods common to more than one section of Division 22 and includes hangers, supports, saddles, shields, clamps, inserts, and miscellaneous materials necessary for the proper hanging and supporting of piping systems. Portions of this Section may not be required in this project. See drawings and each specific system description section of Division 22 for specific sizes; materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. Hangers and supports shall comply with ANSI/Manufacturer's Standardization Society (MSS) SP-58, SP-69 and SP-89. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with these specifications, pipe hanger and support systems shall be as manufactured by one of the following:
 - 1. ANVIL
 - 2. ELCEN
 - 3. ERICO, Inc.
 - 4. Fee and Mason
 - 5. Grinnell
 - 6. Hydra-Zorb Company
 - 7. MetraFlex
 - 8. PHD Manufacturing Inc.
 - 9. Pipe Shields

2.02 PIPE HANGERS AND SUPPORTS

- A. All hangers, brackets, clamps, etc., shall be of standard weight galvanized steel. Perforated strap hangers shall not be used in any work. Each hanger is to be sized to include pipe insulation.
- B. All model numbers referenced within this specification are as manufactured by Erico.

C. When two or more pipes are run parallel, they may be supported on Unistrut type trapeze hangers. Insulation on insulated pipe shall be continuous at trapeze hangers. At each trapeze hanger provide a minimum 12" long insulation protection shield, Model 126 or 127 with 180° calcium silicate shield insert; thickness shall match thickness of insulation.

D. In general, support individual horizontal piping as follows:

Table 22 12 20.1

Pipe Description	Pipe Size	Hanger Description
Uninsulated steel and plastic piping	2" and smaller	Model 100 heavy duty galvanized steel swivel loop hanger
	2-1/2" and larger	Model 400 carbon steel clevis hanger.
Uninsulated copper piping	2" and smaller	Model 101 copper plated steel swivel loop hanger
	2-1/2" and larger	Model 402 copper plated steel clevis hanger
Insulated piping (hot or cold)	2" and smaller	Model 403 carbon steel clevis hanger for insulated pipe (thickness to match adjacent pipe insulation). Insulation vapor barrier to be continuous at each hanger
Insulated hot piping	2-1/2" and larger	Model 610 steel one rod roller hanger with carbon steel pipe insulation protection saddle. Saddle size shall match adjacent piping insulation thickness.
Insulated cold piping	2-1/2" and larger	Model 403 carbon steel clevis hanger for insulated pipe with insulation protection shield spot welded in place. Install with 180° hard block calcium silicate insert with foil faced back (thickness to match adjacent pipe insulation). Insulation vapor barrier to be continuous at each hanger.

E. Support all pipe hangers from all-thread rod with additional lock nut. All-thread rod size shall match hanger attachment size. Attach all hangers to the structure with concrete inserts, "C" clamps, beam clamps, or ceiling flanges.

1. Hangers and supports anchored to poured concrete: Use malleable iron or steel concrete inserts attached to concrete forms.
2. Hangers or supports anchored to precast concrete: Use self-drilling expansion shields. Expansion shields may also be used where concrete inserts have been missed or additional support is required in poured concrete.
3. Attach all-thread rod 5/8" or smaller to steel with malleable iron beam clamps with carbon steel retainer strap.
4. Attach all-thread rod 3/4" or larger to steel with carbon steel center-load beam clamps with forged steel eye nut.
5. Attach all-thread rod to ceiling with malleable iron ceiling flanges, anchored to structural member above ceiling.
6. All adhesive hangers shall be approved for use with cracked concrete per the American Concrete Institute and ICC-ES standard AC308. All mechanical hangers shall be approved for use with cracked concrete per the American Concrete Institute and ICC-ES standard AC193.

F. Where piping is supported from below, support on carbon steel pipe saddle supports. Where piping is insulated, furnish with protection shields, insulation inserts and protection saddles similar to those used with pipe hangers. Support 2-1/2" or larger hot piping on roller supports.

- G. In supporting cold piping systems, hanger installation shall permit the installation of a continuous insulation vapor barrier.
- H. All insulated vertical or horizontal piping supported from walls shall have continuous insulation at all support clamps. At each support clamp provide a 360 degree thermoplastic elastomer cushion insert or calcium silicate shield insert; thickness shall match thickness of insulation. Provide continuous vapor barrier.
- I. All non-insulated vertical or horizontal piping supported from walls shall have a 360 degree thermoplastic elastomer cushion insert at each support clamp.

2.03 VERTICAL PIPE FRICTION CLAMPS

- A. In general support all vertical piping with friction type riser clamps - Model 450 or 451 for uninsulated pipes or Model 452 for insulated pipes.
 - 1. Steel or cast iron piping – carbon steel.
 - 2. Copper piping – copper plated carbon steel.

2.04 MANUFACTURED UNITS

- A. Hangers and support components shall be factory fabricated of materials, design and manufacturer complying with MSS SP-58.
 - 1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
- B. Thermal Hanger Shield Inserts: 100 psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover a 180 degree circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide all hangers, supports and clamps to properly support and retain piping, to control expansion, contraction and drainage and to prevent sway and vibration.
- B. Examine areas and conditions where the hangers, supports, clamps and inserts are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Proceed only after the required building structural work has been completed in the area where the piping is to be installed.
- C. The use of explosive force hammer actuated, booster assist or similar anchoring device is not permitted without prior approval from the Architect.
- D. Provide all supplementary angles, channels, rails and plates required for support of piping. Attach to building structural members by welding, bolting or anchoring. Ceiling flanges shall be secured to the structural member above ceiling - anchoring ceiling flanges to drywall "only" is not acceptable.
- E. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze hangers. Construct of a channel or unistrut with adjustable all-thread rods. Hanger spacing shall be determined by the smallest pipe supported. Provide all insulation protection shields, insulation inserts and protection saddles similar to those used with individual hangers. In supporting cold piping systems, trapeze hanger installation shall permit the installation of a continuous insulation vapor barrier.
- F. Install hangers and supports to allow for controlled movement of the piping system, to permit movement between pipe anchors and to facilitate the action of expansion joints and bends.
- G. Install hangers and supports to provide indicated pipe slopes.
- H. Support all fire protection piping independently of other piping, per NFPA requirements.
- I. Do not support piping from another pipe or from ductwork or equipment. Do not support ceiling framing or lighting from piping.

- J. Adjust hangers and supports to equally distribute the load between all supporting members.
- K. Support all vertical copper piping with riser clamps at intervals not over 10 feet. Support all vertical steel piping at intervals not over 15 feet.
- L. Support all piping independently from equipment and isolate to prevent transmission of vibration of equipment to piping. No piping is to impose a load upon the equipment to which it is connected.
- M. If any fire proofing materials are disturbed while attaching piping hangers and supports, patch/repair those areas with the same fire proofing materials and of the same thickness as adjacent areas.

END OF SECTION 22 12 20

**SECTION 22 12 30
THERMOMETERS AND GAUGES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies thermometers and gauges common to more than one section of Division 22 and includes materials, specialties, and basic installation instructions. Portions of this Section may not be required in this project. See drawings and each specific system description section of Division 22 for specific sizes; materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. UL Compliance:
 - 1. Comply with applicable UL standards pertaining to thermometers and gauges.
 - 2. Comply with NSF/ANSI 372 for use in potable water applications
- B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of thermometers and gauges.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 THERMOMETERS

- A. Acceptable manufacturers: Subject to compliance with requirements, provide thermometers as manufactured by one of the following:
 - 1. Tterice Co.
 - 2. Weiss Instruments, Inc.
 - 3. Marshalltown Instruments, Inc.
- B. Provide thermometers in a die cast aluminum case and adjustable joint with baked enamel finish, 9" long, with spring secured heavy glass front and locking device capable of 180° vertical and 360° horizontal adjustment. Non-toxic red safety liquid filled-magnifying lens, red reading tube, silicone shock-mounted, one percent accuracy. Satin faced non-reflective aluminum scale with permanently etched markings. Copper-plated steel stem, separable socket well, length to suit installation. Thermometers shall be suitable for the service of the piping system where installed.
- C. Thermometer wells shall be brass in copper pipe and stainless steel in steel pipe, pressure rated to match piping system design pressure. Where piping is to be insulated, provide with extension.
- D. Scale temperature ranges as follows:

1. Hot water: 30° - 240°F
2. Cold water: 0° - 100°F

2.02 PRESSURE GAUGES (WATER/STEAM)

- A. Acceptable manufacturers: Subject to compliance with requirements, provide pressure gauges as manufactured by one of the following:
 1. H.O. Terrice Co.
 2. Weiss Instruments, Inc.
 3. Marshalltown Instruments, Inc.
 4. Dwyer Instruments, Inc
 5. Pasco Specialty & Mfg, Inc.
 6. Weksler, a brand of Ashcroft –Nagano Keiki Holdings, Inc.
- B. General use, ANSI B40.1 grade A, with accuracy of plus or minus 1%. Phosphor bronze bourdon-tube and brass socket for 1/4" NPT bottom connection. 4-1/2" diameter steel case with clear acrylic plastic lense. Aluminum dial with white background and permanently etched black markings. Aluminum pointer with black finish.
- C. Provide gauges with 1/4" NPT brass bushing snubbers with corrosion resistant porous metal disc suitable for the service and pressure rating of the piping system where installed. Between gauge and tee in piping system, provide 1/4" bronze body, threaded ball valve suitable for the service and pressure rating of the piping system where installed.
- D. Where pressure gauge is installed in a steam system provide 1/4" NPT straight type brass steam gauge syphon.
- E. Range: Conform to the following:
Domestic hot and cold water: 30 to 150 psig.

2.03 PRESSURE GAUGES (NATURAL GAS)

- A. Acceptable manufacturers: Subject to compliance with requirements, provide pressure gauges as manufactured by one of the following:
 1. H.O. Terrice Co.
 2. Weiss Instruments, Inc.
 3. Marshalltown Instruments, Inc.
 4. Dwyer Instruments, Inc
 5. Pasco Specialty & Mfg, Inc.
 6. Weksler, a brand of Ashcroft –Nagano Keiki Holdings, Inc.
- B. Natural gas pressure gauges shall conform to ANSI B40.100 , with accuracy of plus or minus 1.6%.
- C. Gauges shall contain brass movement with 316L stainless steel diaphragm capsule and brass socket for 1/4" NPT bottom connection.
- D. Gauges shall have a 4" diameter black finished steel case with clear polycarbonate lens, an aluminum dial with white background and permanently etched black markings and an aluminum pointer with black finish, adjustable via screw on dial face.
- E. Between gauge and tee in piping system, provide a 1/4" bronze body, threaded ball valve suitable for the service and pressure rating of the piping system where installed.
- F. Range: Conform to the following:

0 to 15 inches w.c. – for low pressure natural gas (less than 10 inches w.c.)

0 to 30 inches w.c. – for low pressure natural gas (zero to 14 inches w.c.)

0 to 3 psi – for low pressure natural gas (zero to 2 psi)

0 to 10 psi – for intermediate pressure natural gas (zero to 5 psi)

PART 3 EXECUTION

3.01 THERMOMETERS INSTALLATION

- A. Install thermometers in vertical or tilted positions to allow reading by observer standing on the floor. Install thermometer wells in the vertical position. Fill well with oil or graphite and secure cap. Adjust faces to proper angle for best visibility.
- B. Install hydronic thermometers in the following locations and elsewhere as indicated
 - 1. At outlet of each domestic water heater.
 - 2. At inlet and outlet of each main thermostatic mixing valve.
 - 3. At outlet of each domestic hot water recirculating pump.

3.02 PRESSURE GAUGES INSTALLATION

- A. Install pressure gauges located in the piping at the most readable location for an observer standing on the floor. Install with shut off valve and snubber. For steam systems install with gauge siphon, Pressure gauges shall be installed as close as possible to the equipment or apparatus to indicate pressure changes across equipment or apparatus only. Adjust faces to proper angle for best visibility.
- B. Install hydronic pressure gauges in the following locations and elsewhere as indicated.
 - 1. At outlet of each domestic water service backflow preventer.
 - 2. At inlet and outlet of each domestic hot water circulating pump.
 - 3. At inlet and outlet of domestic water booster pumps.
 - 4. At outlet of each domestic hot water heater with input greater than 200 MBH.
- C. Install natural gas pressure gauges in the following locations and elsewhere as indicated.
 - 1. At gas inlet of each domestic hot water heater.
 - 2. At gas inlet of each domestic hot water boiler.
 - 3. At inlet and outlet of each gas pressure regulator.

3.03 ADJUSTING AND CLEANING

- A. Adjusting: Adjust faces of thermometers and gauges to proper angle for best visibility.
- B. Cleaning: Clean windows of thermometers and gauges and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.
- C. Connections: Piping installation requirements are specified in other sections of Division 22. The drawings indicate the general arrangement of piping, fittings and specialties. The following are specific connection requirements:
 - 1. Install thermometers and gauges piping adjacent to equipment to allow servicing and maintaining of equipment.

END OF SECTION 22 12 30

**SECTION 22 12 40
FLEXIBLE PIPE CONNECTORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies flexible pipe connectors common to more than one section of Division 22 and includes materials, specialties, and basic installation instructions. Portions of this Section may not be required in this project. See drawings and each specific system description section of Division 22 for specific sizes; materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Provide flexible pipe connectors of same type by same manufacturer.

1.04 CODES AND STANDARDS

- A. ASME Compliance: Manufacture and install flexible pipe connectors in accordance with ASME B31.9 "Building Services Piping."

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide flexible pipe connectors as manufactured by one of the following:
 - 1. Hyspan Precision Products, Inc.
 - 2. Keflex, Inc.
 - 3. Mason Industries
 - 4. Metraflex

2.02 WOVEN HOSE FLEXIBLE CONNECTORS

- A. Stainless steel hose covered with stainless steel wire braid with MPT nipples rated at minimum 600 psig working at 250°F.
- B. Class flanges rated at 125 psig and 240°F maximum temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which flexible pipe connectors are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install where indicated on the drawings and according to manufacturer's recommendations. Install in the following locations, even if not specifically indicated on the drawings:
 - 1. Install woven hose flexible connectors on the hot water piping connections to each inline recirculating water pump.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of flexible pipe connectors and after units are water pressurized, test units to demonstrate capability and compliance with requirements.
- B. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 22 12 40

**SECTION 22 12 50
WATER HAMMER ARRESTORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies water hammer arrestors and includes materials, testing and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All plumbing systems shall comply with the Local Plumbing Code and all requirements of the local authority having jurisdiction.
- B. Plumbing systems shall comply with ANSI, ASPE, ASSE ASTM, CSA, NSF, and AWWA requirements.
- C. Water hammer arrestors (shock stops) shall comply with ANSI/ASME A112.26.1M and ASSE 1010.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide water hammer arrestors as manufactured by one of the following:
 - 1. Zurn Industries, Inc.
 - 2. Josam
 - 3. J.R. Smith
 - 4. Wade

2.02 CONSTRUCTION

- A. Water hammer arrestors shall be bellows type. Casing and bellows shall be constructed of stainless steel.

2.03 PERFORMANCE

- A. Shock stops shall have sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system.
- B. Shock stops shall be tested and certified in accordance with the Plumbing Drainage Institute "Standard PDI WH-201".

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide a water hammer arrestor at each solenoid valve, flush valve, washer machine water feed, or piece of equipment that has a quick-closing type valve or as indicated on the drawings. Water hammer arrestors for down-feed risers to be installed at top of riser.
- B. Size water hammer arrestor according to fixture unit count.
- C. Provide water hammer arrestor at each group of water closets and urinals as indicated.

3.02 CONNECTIONS

- A. Water Hammer Arrestors
 - 1. Coordinate installation location with architectural wall and ceiling design. Where concealed within a plumbing chase or above a drywall ceiling, the General Contractor shall provide an access door of sufficient size so as to facilitate servicing and replacement of the device. Access doors shall match any ratings of the wall or ceiling where installed.
 - 2. Install water hammer arresters in water piping with a shutoff isolation valve.

3.03 INSPECTION, TESTING AND DISINFECTION

- A. Water hammer arrestors shall be subjected to the same pressure test specified for domestic water piping. Installer shall verify arrestors are capable of withstanding the specified pressure and duration of the test.
- B. Water hammer arrestors shall be subjected to the same chlorination/sanitation procedure specified for domestic water piping. Installer shall verify arrestors are capable of withstanding the specified procedure and any chemicals utilized to perform such procedures.

3.04 FIELD QUALITY CONTROL

- A. Upon completion of installation of water hammer arrestors and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 22 12 50

**SECTION 22 12 60
CLEANOUTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies cleanout materials and installation methods for gravity drained sanitary and storm water piping systems and includes fittings, joining methods and basic installation instructions.
- B. Portions of this Section may not be required in this project. See drawings for specific requirements and cleanout sizes pertaining to this project.
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 SPECIFIC CODES AND STANDARDS

- A. Furnish and install cleanouts in accordance with regulations required by local the local authority having jurisdiction.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Storage: Elevate above grade and do not exceed structural capacity of the floor or structure.
- B. Provide factory-applied plastic shrink-wrap on each cleanout. Maintain through shipping, storage, and handling to prevent damage and prevent entrance of dirt, debris and moisture.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 GENERAL

- A. Cleanouts shall be constructed of materials as herein specified, and joined to associated piping system with joining methods as specified in other sections.

2.02 EXPOSED METAL CLEANOUTS

- A. Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Josam Company; Josam Div.
 - 2. MIFAB, Inc.
 - 3. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - 4. Tyler Pipe; Wade Div.
 - 5. Watts Drainage Products Inc.
 - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 7. Josam Company; Blucher-Josam Div.
- B. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
- C. Size: Same as connected drainage piping.

- D. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
- E. Closure: Countersunk cast-iron plug.
- F. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- G. Closure: Stainless-steel plug seal.

2.03 METAL FLOOR CLEANOUTS

- A. Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Josam Company; Josam Div.
 - 2. Oatey.
 - 3. Sioux Chief Manufacturing Company, Inc.
 - 4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - 5. Tyler Pipe; Wade Div.
 - 6. Watts Drainage Products Inc.
 - 7. Zurn Plumbing Products Group; Light Commercial Operation.
 - 8. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 9. Josam Company; Josam Div.
 - 10. Kusel Equipment Co.
 - 11. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - 12. Josam Company; Blucher-Josam Div.
- B. Standard: ASME A112.36.2M heavy-duty, adjustable housing cleanout.
- C. Size: Same as connected branch (see Part 3 – Execution).
- D. Type: Heavy-duty, adjustable housing.
- E. Body or Ferrule: Cast iron.
- F. Clamping Device: Not required.
- G. Outlet Connection: Threaded.
- H. Closure: Cast-iron plug.
- I. Adjustable Housing Material: Cast iron with threads.
- J. Frame and Cover Material and Finish: Rough bronze.
- K. Frame and Cover Shape: Round.
- L. Top Loading Classification: Medium Duty (unless scheduled differently).
- M. Riser: ASTM A 74, Extra-Heavy Service class, cast-iron drainage pipe fitting and riser to cleanout.
- N. Standard: ASME A112.3.1.
- O. Size: Same as connected branch.
- P. Housing: Stainless steel.
- Q. Closure: Stainless steel with seal.
- R. Riser: Stainless-steel drainage pipe fitting to cleanout.

2.04 CAST-IRON WALL CLEANOUTS

- A. Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Josam Company; Josam Div.

2. MIFAB, Inc.
 3. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 4. Tyler Pipe; Wade Div.
 5. Watts Drainage Products Inc.
 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Standard: ASME A112.36.2M. Include wall access.
 - C. Size: Same as connected drainage piping (see Part 3 – Execution).
 - D. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - E. Closure: Countersunk plug.
 - F. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - G. Wall Access: Round, flat, chrome-plated brass cover plate with screw (unless scheduled differently).

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. Installation shall conform to all requirements in “Common Piping Requirements” section of these Division 22 Specifications.
- B. Where change of direction in the piping system is greater than 45°, install wye fitting with required bends and clean-out.
- C. Provide clean-outs at the base of all stacks and vertical storm leaders; at changes of direction in horizontal drain piping greater than 45° and as shown on the drawings. Provide clean-outs in horizontal straight runs of piping at intervals not over 50'. Install clean-outs wherever storm sewers and sanitary sewers exit the building.
- D. Clean-outs in concealed piping or piping below the floor shall be extended through and terminate flush with the finished floor above.
- E. Clean-outs shall be the same size as the pipe to which they are connected up to 4". Pipes larger than 4" shall have a 6" clean-out.
- F. Install all clean outs with required clearance for rodding.

3.02 CLEANING

- A. After piping installation is complete, thoroughly flush the piping system with a material/detergent that is not injurious to the pipe, to remove all pipe dope, oils, welding slag, scale and other extraneous material.

3.03 TESTING

- A. All plumbing piping systems specified herein shall be hydrostatically tested per the “Piping Systems Flushing and Testing” section of Division 22 Specifications.

END OF SECTION 22 12 60

**SECTION 22 13 10
DOMESTIC WATER VALVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies valves used in plumbing piping systems and includes general descriptions and installation methods.

1.03 DEFINITIONS

- A. ANSI - American National Standards Institute
- B. ASME - American Society of Mechanical Engineers
- C. CWP - Cold Working Pressure
- D. EPDM - Ethylene Propylene Diene Monomer
- E. PSI - Pounds per square inch
- F. PSID - Pounds per square inch differential
- G. PSIG - Pounds per square inch gage
- H. P/T - Pressure and Temperature

1.04 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.
- B. NSF Compliance:
 - 1. All domestic water valves shall comply with NSF 61 and NSF 372 for low lead content.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set ball, plug, and balance valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
 - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use a sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.06 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.

- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 GENERAL VALVE REQUIREMENTS

- A. Where possible provide all valves of the same manufacturer. All valves shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the valve body.
- B. Provide factory-fabricated valves of types and temperature/pressure ratings as indicated, suitable for the service in which the valve is installed.
- C. Unless otherwise indicated, provide valves of same size as the pipe in which it is installed.
- D. Where valves are to be insulated, provide an extended stem arranged to receive insulation.

2.02 SHUT-OFF VALVES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide shut-off valves as manufactured by one of the following:
 - 1. 2" and smaller: Bronze body, two piece, full port ball valves with lever handle, Teflon seats, chrome plated brass ball, brass stem and threaded ends, 600 psi CWP.
 - a. Apollo
 - b. Hammond
 - c. Jomar Valve
 - d. Milwaukee
 - e. Nibco
 - f. Stockham
 - g. Watts
 - 2. 2-1/2" and larger (in welded systems): Cast iron body, lug type butterfly valves with stainless steel stem, aluminum bronze disc and EPDM liner, 200 psi working pressure. Operators: Provide lever handles for sizes 2-1/2" to 6"; provide gear operators for sizes 8" and larger; provide chain operators for sizes 8" and larger installed 10'-0" or more above the finished floor in mechanical rooms (chain shall provide operation at 6'-0" above finished floor).
 - a. Apollo
 - b. Hammond
 - c. Metraflex
 - d. Milwaukee
 - e. Nexus
 - f. Nibco
 - g. Stockham

2.03 HORIZONTAL SWING CHECK VALVES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide horizontal swing check valves as manufactured by one of the following:
 - 1. 2" and smaller: Bronze body, bronze disc, horizontal swing type with threaded ends, 200 psi CWP.
 - a. Crane
 - b. Hammond

- c. Jenkins
- d. Milwaukee
- e. Nibco
- f. Stockham

2.04 MANUAL BALANCING VALVES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide manual balancing valves as manufactured by one of the following:
 - 1. 2" and smaller: Bronze body, combination venturi and ball valve with lever handle, memory stop, two P/T ports, inlet union connection and threaded ends, 400 psi at 250°F.
 - a. Bell & Gossett
 - b. Flow Design Inc.
 - c. Griswold
 - d. Nexus
 - e. Hydronic Components

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.
- F. All valves shall be installed in accessible locations in a position to allow full stem movement. On horizontal overhead runs, install valves with stems in the horizontal position. On horizontal runs near the floor, install valves with stem in the vertical or 45 degree angle position.

3.02 SHUT-OFF VALVE INSTALLATION

- A. Shut-off valves shall be provided at all branch connections to piping mains, at bases of all risers, at each piece of equipment, in piping mains to sectionalize the systems and elsewhere as indicated. Valve locations shall permit proper and safe operation of all systems and facilitate maintenance and/or removal of all equipment and apparatus.
- B. In no case shall valves be installed with stems below the horizontal position.
- C. Valves shall be installed full line size. Piping reductions shall be made only at the inlet or outlet of pressure reducing valves, regulating valves, or equipment.

3.03 SWING CHECK VALVE INSTALLATION

- A. Install swing check valves in vertical position with flow upward or in the horizontal position with hinge pin horizontally perpendicular to the centerline of the pipe. Install for proper direction of flow.

- B. If faucets or hose bibbs with hose thread outlets do not have integral check valves, provide check valves in hot and cold water piping serving this equipment.
- C. If mixing valves do not have integral check valves, provide check valves in hot and cold water piping serving this equipment.

3.04 BALANCE VALVE INSTALLATION

- A. Install balancing valves with at least the minimum straight length of pipe, upstream and downstream of the valve, required by the manufacturer for maximum accuracy.
- B. The Division 23 balancing Contractor shall document flows for balance valves.**

3.05 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 22 13 10

**SECTION 22 13 11
DOMESTIC WATER MIXING VALVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies mixing valves used in domestic water piping systems and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against contamination.
 - 2. Protect thread ends.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Where possible provide all valves of the same manufacturer. All valves shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the valve body.
- B. Provide factory-fabricated valves of types and temperature/pressure ratings as indicated, suitable for the service in which the valve is installed.
- C. Unless otherwise indicated, provide valves of same size as the pipe in which it is installed.

2.02 INDIVIDUAL-FIXTURE, WATER TEMPERING VALVES

- A. Manufacturers: Subject to compliance with requirements, provide tempering valves as manufactured by one of the following:
 - 1. Apollo Valves
 - 2. Armstrong International, Inc.
 - 3. Conbraco Industries, Inc.
 - 4. Lawler Manufacturing Company, Inc.
 - 5. Leonard Valve Company
 - 6. Powers; a Watts Industries Co.
 - 7. Watts Industries, Inc.; Water Products Div.

- 8. Zurn Plumbing Products Group; Wilkins Div.
- B. Provide below deck thermostatic water mixing valve for use with a single electronic faucet.
- C. Thermostatic water mixing valve shall have the following features:
 - 1. Designed for under-the-lavatory applications where the outlet temperature of hot water must be controlled for safe, economic use.
 - 2. Designed to quickly sense and compensate for temperature fluctuations induced by water temperature and pressure changes in the supply line.
 - 3. Water temperature adjustment stem with lock nut to prevent tampering.
 - 4. Inlet supply lines to be installed with check valves. Integral check valves alone not acceptable.
 - 5. Standards: Complies with performance standards ASSE 1070 and CSA B125 for thermostatically controlled water tempering valve.
 - 6. Pressure Rating: 125 psig minimum.
 - 7. Body: Lead free bronze body with corrosion-resistant interior components.
 - 8. Temperature Control: Adjustable – 80-120°F range.
 - 9. Inlets and Outlet: Threaded or 3/8" compression connections.
 - 10. Finish: Rough or chrome-plated bronze.
 - 11. Tempered-Water Setting: **110 deg F**.
 - 12. Minimum Activation Flow: **0.25 gpm**.
 - 13. Maximum 5 psi pressure drop @ 1.5 gpm.

2.03 PRIMARY THERMOSTATIC MIXING VALVES (FOR MULTIPLE FIXTURES)

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide mixing valves as manufactured by one of the following:
 - 1. Apollo Valves
 - 2. Armstrong International, Inc.
 - 3. Conbraco Industries, Inc.
 - 4. Lawler Manufacturing Company, Inc.
 - 5. Leonard Valve Company
 - 6. Powers; a Watts Industries Co.
 - 7. Watts Industries, Inc.; Water Products Div.
 - 8. Zurn Plumbing Products Group; Wilkins Div.
- B. Standard: ASSE 1017 and 1070.
- C. Pressure Rating: 125 psig.
- D. Material: Lead free bronze body with corrosion-resistant interior components.
- E. Connections: Threaded [**Union**] inlet and outlet.
- F. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle. Integral check valves alone not acceptable.
- G. Valve Pressure Rating: 125 psig minimum.
- H. Tempered-Water Setting: **110 deg F**
- I. Maximum 5-psig Pressure Drop: @ 3.5 gpm

- J. Minimum activation flow 0.35 gpm.
- K. Cabinet (when applicable): Factory-fabricated, stainless steel, for [recessed] [surface] mounting and with hinged, stainless-steel door.

2.04 MASTER THERMOSTATIC WATER MIXING VALVE ASSEMBLIES (MECHANICAL)

- A. Manufacturers: Subject to compliance with requirements, provide mixing valves as manufactured by one of the following:
 - 1. Apollo Valves
 - 2. Armstrong International, Inc.
 - 3. Conbraco Industries, Inc.
 - 4. Lawler Manufacturing Company, Inc.
 - 5. Leonard Valve Company
 - 6. Powers; a Watts Industries Co.
 - 7. Watts Industries, Inc.; Water Products Div.
 - 8. Zurn Plumbing Products Group; Wilkins Div.
 - 9. Description: Provide factory-fabricated, [cabinet-type] [exposed-mounting], thermostatically controlled, water-mixing-valve assemblies in parallel arrangement. Thermostatic water mixing valves shall include copper encapsulated paraffin-based thermostat, locking temperature regulator handle, integral hot and cold supply checkstops, integral wall support, and internal parts of brass, bronze, and stainless steel construction. Finish shall be rough bronze.
 - 10. Thermostatic Mixing Valves shall comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet. Integral check valves alone not acceptable.
 - 11. Water Regulator(s) shall comply with ASSE 1003. Include pressure gage on inlet and outlet.
 - 12. Component Pressure Rating shall be 125 psig minimum.
 - 13. Cabinet (when applicable): Factory-fabricated, stainless steel, for [recessed] [surface] mounting and with hinged, stainless-steel door.
 - 14. Tempered-Water Setting: **120 deg F**
 - 15. Unit Minimum ActicationTempered-Water Design Flow Rate: **5 gpm**
 - 16. Mixing Valves shall be ASSE Listed and 3rd Party certified as Lead Free.

2.05 MASTER THERMOSTATIC WATER MIXING VALVE ASSEMBLIES (DIGITAL)

- A. Manufacturers:
 - 1. Subject to compliance with requirements, provide mixing valves as manufactured by one of the following:
 - a. Armstrong
 - b. Leonard Valve Co.
 - c. Power; a Watts Industries Co.
- B. Description:
 - 1. Provide factory fabricated, exposed-mounting, electronically controlled, water-mixing-valve assemblies as indicated on the drawings. Electronic mixing valves shall be utilized in continuously pumped systems.
 - 2. Stainless steel valve construction with polymer electronics enclosure.

3. Comply with ASSE 1017, CSA B125 and shall be CE Certified.
4. Furnish each mixing valve with integral check stops on hot-and cold-water inlets and shutoff valve on tempered water outlet.
5. Pressure Rating shall be 125 psig minimum.
6. Power shall be 100-240V AC.
7. Mixing Valves shall be ASSE Listed and 3rd Party certified as Lead Free.

C. Operations

1. Tempered-Water Setting: Per drawings
2. Unit Minimum Tempered-Water Design Flow Rate: 5 gpm
3. Maximum inlet water temperature shall be 185 def F.
4. Furnish with digital controller with integral display. Display shall be capable of indicating:
 - a. Set-point (deg F)
 - b. Inlet hot water temperature (deg F)
 - c. Error Codes
 - d. Alarm Condition
5. Furnish controller with serial communication connection capable of integrating to the building automation system via the following protocols:
 - a. BACnet MS/TP
 - b. Modbus
 - c. Lon Works

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness and freedom from foreign matter. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.

3.02 INSTALLATION

- A. Install per manufacturer's installation requirements
- B. Horizontal check valves shall be provided at all cold water and hot water connections to mop basins, service sinks, and all mixing/tempering valves.
- C. Provide shutoff valve on cold water and hot water inlets of each mixing valve. Locate shutoff valves in ceiling space or another accessible location.

3.03 ADJUSTMENT

- A. Once the mixing valve is installed, adjust hot and cold water inlets to achieve scheduled outlet water temperature.

END OF SECTION 22 13 11

SECTION 22 13 12
DOMESTIC WATER PRESSURE REDUCING VALVES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies pressure reducing valves used in plumbing piping systems and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. All plumbing systems shall comply with the Local Plumbing Code and all requirements of the local authority having jurisdiction.
- B. Plumbing systems shall comply with ANSI, ASPE, ASSE, ASTM, CSA, NSF, and AWWA requirements.
- C. Compliance:
 - 1. ASSE 1003 (ANSI A112.26.2) and IAPMO and certified to CSA B356
 - 2. Certified by NSF to ANSI/NSF standard 61 annex G.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide shut-off valves as manufactured by one of the following:
 - 1. Apollo
 - 2. Conbraco
 - 3. Fisher
 - 4. Taco

5. Watts Industries, Inc.; Water Products Div.
6. Zurn Plumbing Products Group; Wilkins Div.

2.02 CONSTRUCTION

- A. Pressure Reducing Valves (PRV's) shall be manufactured of lead free materials, rated for use in potable water systems.
- B. Construct of bronze with chrome-plated finish or cast iron (with interior lining complying with AWWA C550) body with integral inlet and outlet unions and integral stainless steel strainer and thermal expansion backflow bypass, with thermoplastic seat and cage, elastomer valve disc and reinforced EPDM diaphragm.
- C. Inlet pressure: Rate for 150 psi.
- D. Discharge Pressure: Rated up to 100 psi, with adjustment range as scheduled.
- E. Furnish with threaded ends for 2" NPS and smaller, flanged for 2 ½" NPS and larger.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine pressure reducing valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Examine threads on valve and mating pipe for form and cleanliness.
- C. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- D. Do not attempt to repair defective valves; replace with new valves.
- E. All valves shall be installed in accessible locations in a position as recommended by the manufacturer to facilitate proper operation.

3.02 INSTALLATION

- A. Install water service main pressure reducing valves indoors and downstream of backflow preventer wherever the service main pressure exceeds 80 psig. Provide pressure gauge on outlet of the assembly. Install assembly per the local water department requirements.
- B. Provided where indicated on plans. Valve locations shall permit proper and safe operation of all systems and facilitate maintenance and/or removal of all equipment and apparatus.
- C. In no case shall valves be installed with stems below the horizontal position.
- D. Valves shall be of sizes as indicated on the plans. Piping reductions shall be made at the inlet or outlet of pressure reducing valves.

3.03 ADJUSTING

- A. Adjust valve discharge pressure to pressure indicated on plans, or as recommended by equipment manufacturer being supplied by valve.

END OF SECTION 22 13 12

**SECTION 22 13 20
NATURAL GAS VALVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping and valves for natural gas systems installed inside or outside above grade and includes materials, testing and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All natural gas systems shall comply with the latest "International Fuel Gas Code", and local utility requirements.
- B. Natural gas valves shall comply with ASME B16.44 up to 5 psig.
- C. Natural gas valves shall comply with ANSI Z21.15 and ASME B16.33 up to 125 psig.
- D. Natural gas valves shall be tested and listed in accordance with Underwriters Laboratories UL 842. The UL mark shall be on the valves.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 SHUT-OFF VALVES

- A. Acceptable Manufacturers
 - 1. Manufacturer: Subject to compliance with these specifications, natural gas valves shall be as manufactured by one of the following:
 - a. Valves 2" smaller:
 - 1). Apollo, Conbraco Industries
 - 2). Keystone
 - 3). Milwaukee
 - 4). Nibco
 - b. Valves 2½" and larger:
 - 1). Dezurik
 - 2). Homestead
 - 3). Key Port
 - 4). Keystone
 - 5). Nordstrom. Flowserve Corp.
 - 6). Resun, R+M Energy Systems

- B. Valves 2" and smaller shall be forged brass or bronze body, full port ball valves with lever handle, PTFE seats, chrome plated brass ball and threaded ends, 600 psi CWP, with 5 psig pressure limit.
- C. Valves 2-1/2" and larger shall be 175# WOG, cast iron, flanged body pattern lubricated plug type. Valves shall be UL listed for gas service. Provide valves with a removable wrench to match operator square head size. Wrenches shall be locked in place with a set screw. One wrench shall be supplied for every four valves. Valves requiring manual lubricant shall be provided with grease gun, 12" hose, coupler, and one-year's supply of sealant.

PART 3 EXECUTION

3.01 GENERAL

- A. Install valves in all locations as shown on the drawings
- B. Install valves at all connections made to all equipment, whether indicated on the drawings or not. Provide a line-size shut-off valve, union and tee with full sized dirt leg (sediment trap) at all equipment connections. Lubricate all valves before putting the valves into service. Reduce pipe at equipment – downstream of valve.
- C. Valves shall NOT be installed in portions of piping systems installed in concealed locations (i.e., inside stud walls) or within return air plenums. Valves shall be accessible.
- D. All valves installed outdoors shall be painted with primer, and then two coats of rust inhibited paint-color as selected by the Architect.
- E. Shut-off valves for kitchen hood fire suppression furnished by others shall be installed by the Plumbing Contractor. Interconnecting linkage or wiring shall be provided by others.

3.02 TESTING

- A. All gas valves installed in gas piping systems shall be required to withstand the same inspections and testing as the piping system.

END OF SECTION 22 13 20

**SECTION 22 13 21
NATURAL GAS PRESSURE REGULATORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies pressure regulators for natural gas systems installed inside or outside above grade, and includes materials, testing and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All natural gas systems shall comply with the latest "International Fuel Gas Code" and local utility requirements.
- B. Gas regulators shall be ANSI Z21.18 certified.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide gas pressure regulators as manufactured by one of the following:
 - 1. Actaris
 - 2. Itron
 - 3. Maxitrol
 - 4. Schumberger
 - 5. Sprague
 - 6. Norgas

2.02 OPERATION

- A. Regulators shall be capable of regulating gas line pressure from inlet value to outlet value as scheduled on drawings.
- B. Regulators shall, at a minimum, be capable of passing the scheduled required capacity of gas at the scheduled maximum pressure drop.
- C. Regulators shall be protected from over-pressurization with an integral pressure relief mechanism.
- D. Regulators shall be capable of multi-poise mounting.
- E. Regulators shall provide positive dead-end lock up.

2.03 CONSTRUCTION

- A. Regulator body shall be constructed of high tensile strength cast iron.

- B. Orifice shall be constructed of brass.
- C. Regulator Seat shall be constructed of Buna-N or silicone (for temperatures below -20 °F).
- D. Diaphragm shall be constructed of Buna-N and nylon.
- E. Housing shall be die cast aluminum.

2.04 CONNECTIONS

- A. Furnish with flanged inlet and discharge pipe connections, of sizes as indicated on drawings.
- B. If not indicated, provide both inlet and discharge sizes shall be equal to the downstream pipe size.

2.05 WARRANTY

- A. Standard one (1) year manufacturer's warranty.
- B. Warranty shall commence upon project turn over to the owner.

PART 3 EXECUTION

3.01 GENERAL

- A. Install gas pressure regulators as shown on the drawings in accordance with manufacturer's requirement.
- B. Gas pressure regulators shall not be used as grounding electrodes.
- C. Where regulators are installed indoors, pipe regulator excess pressure vented directly to the outdoors with a dedicated pipe. Pipe shall be full discharge connection size. Pipe shall not be combined inside the building with any other vent piping.
- D. Connections to the piping system shall be made to meet the standards required for pipe fittings and joints, as specified in the piping specification section. Fasteners for flanged joints shall be tightened per manufacturer's recommendations.
- E. Install regulators properly so flow through them is oriented in the direction recommended by the manufacturer.
- F. All specialties installed outdoors shall be painted with primer, and then two coats of rust inhibited paint-color as selected by the Architect.
- G. All regulators shall be separately vented full size to the exterior, with a turndown elbow and insect screen. Vent outlet shall not terminate within 20 feet of a combustion or fresh air intake.

3.02 INSPECTION, TESTING, AND PURGING

- A. All gas specialties installed in gas piping systems shall be required to withstand the same inspections and testing as the piping system.

END OF SECTION 22 13 21

SECTION 22 14 10
REDUCED PRESSURE BACKFLOW PREVENTERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the materials and installation requirements for reduced pressure backflow preventers.
- B. Furnish equipment, materials, labor and supervision necessary to provide and install reduced pressure backflow preventers.

1.03 CODES AND STANDARDS

- A. Installation shall conform to the requirements of the local water department.
- B. EPA Compliance: All reduced pressure backflow preventer assemblies shall be in full compliance with EPA requirements.
- C. Plumbing systems shall comply with ASPE, ASSE and AWWA requirements.

1.01 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Conbraco
 - 2. Febco
 - 3. Hersey
 - 4. Watts
 - 5. Wilkins

2.02 REDUCED PRESSURE BACKFLOW PREVENTER

- A. 2" and smaller:
 - 1. Bronze body with stainless steel internal parts.
 - 2. Reduced pressure principle type with differential relief valve located between two positive seating check valves.
 - 3. Assembly shall comply with the requirements of ASSE Standard 1013.
 - 4. Furnish with full port bronze ball valves on inlet and outlet and ball type test cocks.
 - 5. Provide with air gap drain.
 - 6. Maximum working pressure: 175 psi.
- B. 2-1/2" and larger:
 - 1. Epoxy coated (FDA approved) ductile or cast iron body with stainless steel internal parts.

2. Reduced pressure principle type with differential relief valve located between two positive seating check valves.
3. Assembly shall comply with the requirements of ASSE Standard 1013.
4. Furnish with OS&Y gate valves (AWWA approved) on inlet and outlet and ball type test cocks.
5. Provide with air gap drain.
6. Maximum working pressure: 175 psi.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. Provide pressure gauge on outlet of the assembly.
- B. Install assembly per the local water department requirements.
- C. Reduced pressure backflow preventers serving building equipment or systems shall be the same size as the piping.
- D. Installation above a ceiling is not permitted.
- E. Install assembly with a drain line (with air gap) piped to an adjacent floor drain.
- F. Backflow devices must meet ASSE Standards 1013, 1015 and 1020 and shall be tested at the time of installation by a person certified by the **Ohio Department of Health**. The Plumbing Contractor shall pay for all costs associated with this test.

3.02 DELIVERY, STORAGE, HANDLING

- A. Store backflow preventer on site or off site to avoid damage due to construction activity and weather.

3.03 CONNECTIONS

- A. Make final cold water connection and provide necessary piping, materials, and fittings for a complete installation.
- B. Air gap drain pipe size to match drain funnel connection size. Drain piping shall slope to nearest floor drain with a continuous slope, without water traps.

3.04 CLEANING

- A. Remove all fixture labels and clean backflow preventer to remove construction dirt and debris.

END OF SECTION 22 14 10

**SECTION 22 14 20
DUAL CHECK BACKFLOW PREVENTERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the materials and installation requirements for dual check backflow preventers.
- B. Furnish equipment, materials, labor and supervision necessary to provide and install backflow preventers.

1.03 CODES AND STANDARDS

- A. All plumbing systems shall comply with the Local Plumbing Code and all requirements of the local authority having jurisdiction.
- B. Plumbing systems shall comply with ANSI, ASPE, ASSE ASTM, CSA, NSF, and AWWA requirements.
- C. EPA Compliance: Backflow preventers shall be in full compliance with EPA requirements.
- D. Dual check valves (for use with ice makers and humidifiers) shall comply with ANSI/ASSE 1024, CSA B64.6.
- E. Dual check valves (for use with beverage dispensing machines and coffee makers) shall comply with ANSI/ASSE 1022.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Conbraco
 - 2. Febco
 - 3. Hersey
 - 4. Josam
 - 5. J.R. Smith
 - 6. Nibco
 - 7. Watts
 - 8. Wilkins
 - 9. Zurn

2.02 CONSTRUCTION

- A. Assembly shall comply with the requirements of ANSI/ASSE Standard 1024 or ANSI/ASSE Standard 1022.
- B. Cast bronze body with plastic check modules, injection molded with acetyl resin and PPO, with silicone discs and Buna 'N' seals, stainless steel springs. Check modules shall be replaceable.
- C. Furnish with minimum one nut drilled union with O-ring unit seal.
- D. Flow direction arrow shall be permanently affixed to valve body.
- E. Maximum working pressure: 150 psi.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. Install assembly per the local water department requirements. Provide shutoff isolation valve upstream of each dual check valve.

3.02 DELIVERY, STORAGE, HANDLING

- A. Store backflow preventer on site or off site to avoid damage due to construction activity and weather.

3.03 CONNECTIONS

- A. Make final cold water connection and provide necessary piping, materials, and fittings for a complete installation.

3.04 CLEANING

- A. Remove all fixture labels and clean backflow preventer to remove construction dirt and debris.

END OF SECTION 22 14 20

**SECTION 22 17 30
STRAINERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies strainers used in plumbing piping systems and includes general descriptions and installation methods.

1.03 DEFINITIONS

- A. The following are definitions and abbreviations used in this section:
 - 1. ANSI - American National Standards Institute.
 - 2. ASME - American Society of Mechanical Engineers.
 - 3. EPDM - Ethylene Propylene Copolymer Rubber.
 - 4. NSF - National Sanitary Foundation
 - 5. NPT - Nominal Pipe Thread

1.04 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for dimensions and design criteria.
 - 2. NPT threads per ANSI B1.20.1
 - 3. Comply with NSF/ANSI 372 for use in potable water applications

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare strainers for shipping as follows:
 - 1. Protect internal parts against contamination.
 - 2. Protect threads.
- B. Use the following precautions during storage:
 - 1. Maintain end protection.
 - 2. Store indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

PART 2 PRODUCTS

2.01 GENERAL

- A. Where possible provide all strainers of the same manufacturer. All strainers shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the strainer body.
- B. Provide factory-fabricated strainers of types and temperature/pressure ratings as indicated, suitable for the service in which the strainer is installed.

- C. Unless otherwise indicated, provide strainers of same size as the pipe in which it is installed.

2.02 STRAINERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide strainers as manufactured by one of the following:
 - 1. Apollo
 - 2. Armstrong
 - 3. Crane
 - 4. Hayward
 - 5. Mueller
 - 6. Nibco
 - 7. Spirax-Sarco
 - 8. Watts
- B. Strainers 2" and smaller:
 - 1. Cast bronze body.
 - 2. Cover, bronze.
 - 3. Gaskets, EPDM (non asbestos).
 - 4. "Y" configuration.
 - 5. Class 125.
 - 6. Screen shall be type 304 stainless steel with 1/16" (0.062") perforations.
 - 7. Furnish with 3/4" NPT blowdown outlet with ball valve and hose thread cap
 - 8. Furnish with threaded connections.

PART 3 EXECUTION

- A. Examine strainer interior for cleanliness and freedom from foreign matter.
- B. Examine threads on strainer and mating pipe for form and cleanliness.
- C. Do not attempt to repair defective strainers; replace with new.

3.02 INSTALLATION

- A. Strainers shall be installed at the inlet to each pump, control valve, water pressure reducing valve and solenoid valve, and elsewhere as indicated on the drawings.
- B. Locations and orientation shall be as recommended by the manufacturer for proper operation, and to facilitate proper maintenance access and removal of internal screening apparatus.

3.03 ADJUSTING

- A. Clean strainer mesh after piping systems have been tested and put into service but before final adjusting and balancing.

END OF SECTION 22 17 30

SECTION 22 17 31 WYE STRAINERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies strainers used in plumbing piping systems and includes general descriptions and installation methods.

1.03 DEFINITIONS

- A. The following are definitions and abbreviations used in this section:
 - 1. ASME - American Society of Mechanical Engineers.
 - 2. ASTM - American Society for Testing and Materials.
 - 3. EPDM - Ethylene Propylene Diene Monomer.
 - 4. NPT - Nominal Pipe Thread.
 - 5. PSI - Pounds per square inch.

1.04 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 for strainer dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare strainers for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
- B. Use the following precautions during storage:
 - 1. Maintain end protection.
 - 2. Store indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

PART 2 PRODUCTS

2.01 GENERAL

- A. Where possible provide all strainers of the same manufacturer. All strainers shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the strainers body.
- B. Provide factory-fabricated strainers of types and temperature/pressure ratings as indicated, suitable for the service in which the strainer is installed.
- C. Unless otherwise indicated, provide strainers of same size as the pipe in which it is installed.

- D. Where strainers are to be insulated, leave plug accessible provide an extended stem arranged to receive insulation.

2.02 STRAINERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide strainers as manufactured by one of the following:
 - 1. Apollo
 - 2. Armstrong
 - 3. Hammond
 - 4. ITT Hoffman
 - 5. Milwaukee
 - 6. Mueller
 - 7. Nibco
 - 8. Spirax Sarco
 - 9. Stockham
 - 10. Watts
- B. Strainers 2" and Smaller in Copper pipe:
 - 1. Cast bronze body
 - 2. 304 stainless steel screen:
 - a. Sizes ¼" through ½": 40 mesh, 0.010" wire
 - b. Sizes ¾" through 2": 20 mesh, 0.016" wire
 - 3. Operating pressure/temperature: 400 PSI, at 400°F
 - 4. Brass plug
 - 5. Furnish with threaded connections

PART 3 EXECUTION

- A. Examine strainers interior for cleanliness, freedom from foreign matter, and corrosion.
- B. Examine threads on strainers and mating pipe for form and cleanliness.
- C. Do not attempt to repair defective strainers; replace with new.

3.02 INSTALLATION

- A. Strainers shall be installed at the inlet to each pump and elsewhere as indicated on the drawings.
- B. Locations and orientation shall be as recommended by the manufacturer for proper operation, and to facilitate proper maintenance access and removal of internal screening apparatus.
- C. Install all piping with reduction in size being made only at the inlet and outlet of control valves, regulating valves and equipment. All wye strainers shall be installed full line size.

3.03 ADJUSTING

- A. Clean strainer mesh after piping systems have been tested and put into service but before final adjusting and balancing.

END OF SECTION 22 17 31

SECTION 22 18 11
BLADDER TYPE EXPANSION TANKS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies bladder type expansion tanks and includes materials and basic installation instructions.
- B. See drawings for specific sizes; materials and installation methods pertaining to this project.
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of bladder type expansion tanks of sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. ASME Compliance: Manufacture and install bladder type expansion tanks in accordance with ASME Section VIII.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide bladder type expansion tanks as manufactured by one of the following:
 - 1. Amtrol, Inc.
 - 2. Bell and Gossett ITT; Fluid Handling Div.
 - 3. John Wood Company (Alco Industries)
 - 4. Taco, Inc.

2.02 GENERAL

- A. Provide bladder type expansion tanks of the size and type as indicated on the drawings for use in closed potable water systems.

2.03 CONSTRUCTION

- A. Bladder type tanks shall be designed, constructed and stamped in accordance with Section VIII, Division I of ASME Boiler and Pressure Vessel Code and rated for a maximum working pressure of 125 psi at 240°F.
- B. Tank liner shall be polypropylene. Tank fixed diaphragm shall be heavy duty Butyl NSF/ANSI Air 61. Tank shall be prime coated and shall be provided with Schrader air valve with EPDM seat.
- C. Units shall have stainless steel or bronze system connections.

- D. Floor-mounted units shall be furnished with lifting rings, and have the system connection and charging valve at the tank top and tank drain connection at the bottom.
- E. Where scheduled, expansion tanks shall have an internal replaceable elastomer bladder with the minimum acceptance volume and factory precharge pressure as indicated.
- F. Furnish floor mounted tanks with a steel base ring for vertical mounting.

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions where bladder type expansion tanks are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install in-line expansion tanks supported from piping.
- B. Install expansion tanks on floor as indicated, in accordance with manufacturer's instructions.
- C. Vent and purge air from domestic water system, charge tank with proper air charge as recommended by manufacturer.
- D. Provide a shutoff isolation valve at each expansion tank connection. Remove handle and wire to valve. Tag valve – "Valve to be closed only by authorized personnel."

END OF SECTION 22 18 11

**SECTION 22 18 20
PIPE EXPANSION COMPENSATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping expansion loops and fitting materials and installation methods common to more than one section of Division 22 and includes basic piping expansion loop installation instructions. Portions of this Section may not be required in this project. Similarly, other items in the Section might be superseded by more specific requirements in other sections that detail specific systems. See drawings and each specific system description section of Division 22 for specific sizes, materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all piping work described in this Section.

1.03 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.
- C. Shop drawings shall contain the following information:
 - 1. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - 2. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - 3. Schedule: For manufactured expansion loops, indicate type, manufacturer's number, size, material, pressure rating, end connections, location for each expansion joint, and the length of pipe, temperature differential and expansion/contraction length for which the flexible hose is sized.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code – Steel".
 - 2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 MANUFACTURED EXPANSION LOOPS

- A. Manufacturers: Subject to compliance with requirements, provide flexible hose type expansion joints as manufactured by one of the following:
 - 1. Flex-Hose Co., Inc.
 - 2. Flexicraft Industries

3. Flex-Pression, Ltd.
4. Metraflex, Inc.
5. Twin City Hose, Inc.

2.02 GENERAL

- A. It is the installing contractor’s option to provide hard-pipe expansion loops (of the minimum dimensions shown on the drawings) or flexible-hose type expansion joints. Pipe anchors and alignment guides shall be provided for both hard-pipe and flexible-hose type of expansion joints.
- B. The submittal schedule for flexible-hose type expansion joints shall include the specific location of each and the length of pipe, temperature differential and expansion/contraction length for which the flexible hose is sized. The following temperature differentials shall be utilized for sizing expansion joints:

Type of Pipe	Expansion/Contraction Temperature Differential (Degrees Fahrenheit)
Domestic Cold Water	100
Domestic Hot Water	200

2.03 MANUFACTURED EXPANSION JOINTS

- A. Flexible-hose type expansion joints shall be manufactured assemblies with two flexible-metal-hose legs joined by long-radius, 180-degree return bends or a center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.
- B. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with threaded end connections for NPS 2 and smaller and flanged end connections for NPS 2-1/2 and larger.
 1. NPS 2 and Smaller: Bronze hoses and double-braid bronze sheaths with 700 psig at 70 °F and 500 psig at 450 °F ratings.
 2. NPS 2-1/2 to NPS 4: Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 °F and 315 psig at 450 °F ratings.
- C. Flexible-Hose Expansion Joints for Steel Piping: Carbon-steel fittings with
 1. NPS 2 and Smaller: Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 °F and 515 psig at 600 °F ratings.
 2. NPS 2-1/2 to NPS 6: Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 °F and 200 psig at 600 °F ratings.
 3. NPS 8 and Larger: Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 °F and 120 psig at 600 °F ratings.

2.04 ALIGNMENT GUIDES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide alignment guides as manufactured by one of the following:
 1. Adesco Manufacturing, LLC.
 2. Advanced Thermal Systems, Inc.
 3. Flex-Hose Co., Inc.
 4. Flexicraft Industries.
 5. Flex-Weld, Inc.

6. Hyspan Precision Products, Inc.
 7. Metraflex, Inc.
 8. Piping Technology & Products, Inc.
 9. Senior Flexonics, Inc.; Pathway Division
- B. Description: Alignment guides shall be constructed of steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

2.05 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
 1. Stud: Threaded, zinc-coated carbon steel.
 2. Expansion Plug: Zinc-coated steel.
 3. Washer and Nut: Zinc-coated steel.
- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
 1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 3. Washer and Nut: Zinc-coated steel.
- F. Concrete: Portland cement mix, 3000 psi minimum. Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
- G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, 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

3.01 GENERAL

- A. Provide expansion loops at the following locations as indicated on the drawings.
 1. Domestic Hot Water Piping
 2. Domestic Cold Water Piping

3.02 EXPANSION-JOINT INSTALLATION

- A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
- B. Install expansion joints of sizes matching size of piping in which they are installed.
- C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.03 PIPE BEND AND LOOP INSTALLATION

- A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

- B. Attach pipe bends and loops to anchors.
 - 1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.04 SWING CONNECTIONS

- A. Connect risers and branch connections to hot water mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to hot water fixtures with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to hot water fixtures with at least four pipe fittings, including tee in main.

3.05 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion fittings and loops.
- B. Attach guides to pipe and secure to building structure.

3.06 ANCHOR INSTALLATION

- A. 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.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION 22 18 20

**SECTION 22 18 21
MANUFACTURED LOOPS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping expansion loops and fitting materials and installation methods common to more than one section of Division 22 and includes basic piping expansion loop installation instructions. Portions of this Section may not be required in this project. Similarly, other items in the Section might be superseded by more specific requirements in other sections that detail specific systems. See drawings and each specific system description section of Division 22 for specific sizes, materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all piping work described in this Section.

1.03 DEFINITIONS

- A. BR: Butyl rubber.
- B. Buna-N: Nitrile rubber.
- C. CR: Chlorosulfonated polyethylene synthetic rubber.
- D. CSM: Chlorosulfonyl-polyethylene rubber.
- E. EPDM: Ethylene-propylene-diene terpolymer rubber.
- F. NR: Natural rubber.

1.04 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.05 SUBMITTALS

- A. Shop Drawings
 - 1. Provide Shop Drawings for each type and size of expansion loop or fitting.
 - 2. Shop Drawings shall contain the following information:
 - a. General:
 - 1). Model Number
 - 2). Dimensions
 - 3). Weight
 - 4). Material
 - 5). Color and finish
 - 6). Installation recommendations
 - 7). Ratings
 - 8). All included options and accessories
 - b. Performance:
 - 1). Performance data as scheduled and/or specified (at a minimum)

- 2). Code\standard compliance information
- c. Special
 - 1). Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - 2). Alignment Guide Details: Detail field assembly and attachment to building structure.
- B. Operation and Maintenance Manuals
 - 1. O&M Manuals shall include the following:
 - a. Final approved shop drawings, with Engineer's approval attached
 - b. Manufacturer's maintenance instructions, including:
 - 1). Recommended maintenance frequency

1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
 - 2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 EXPANSION JOINTS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide flexible hose type expansion joints as manufactured by one of the following:
 - 1. Flex-Hose Co., Inc.
 - 2. Flexicraft Industries
 - 3. Flex-Pression, Ltd.
 - 4. Metraflex, Inc.
- B. Flexible-Hose Type Expansion Joints: Shall be manufactured assemblies with two flexible-metal-hose legs joined by long-radius, 180-degree return bends or a center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.
- C. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder joint end connections.
 - 1. NPS 2 and Smaller: Bronze hoses and single-braid bronze sheaths with 450 psig at 70 °F and 340 psig at 450 °F ratings.
 - 2. NPS 2-1/2 to NPS 4: Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 °F and 225 psig at 450 °F (1550 kPa at 232 °C) ratings.
- D. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder joint end connections.
 - 1. NPS 2 and Smaller: Bronze hoses and double-braid bronze sheaths with 700 psig at 70 °F and 500 psig at 450 °F ratings.
 - 2. NPS 2-1/2 to NPS 4: Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 °F and 315 psig at 450 °F ratings.
- E. Flexible-Hose Expansion Joints for Steel Piping: Carbon-steel fittings with threaded end connections for NPS 2 and smaller and flanged end connections for NPS 2-1/2 and larger.

1. NPS 2 and Smaller: Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 °F and 325 psig at 600 °F ratings.
 2. NPS 2-1/2 to NPS 6: Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 °F and 145 psig at 600 °F ratings.
 3. NPS 8 to NPS 12: Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 °F and 90 psig at 600 °F ratings.
- F. Flexible-Hose Expansion Joints for Steel Piping: Carbon-steel fittings with threaded end connections for NPS 2 and smaller and flanged end connections for NPS 2-1/2 and larger.
1. NPS 2 and Smaller: Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 °F and 515 psig at 600 °F ratings.
 2. NPS 2-1/2 to NPS 6: Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 °F and 200 psig at 600 °F ratings.
 3. NPS 8 and Larger: Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 °F and 120 psig at 600 °F ratings.

2.02 ALIGNMENT GUIDES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide alignment guides as manufactured by one of the following:
1. AdSCO Manufacturing, LLC.
 2. Advanced Thermal Systems, Inc.
 3. Flex-Hose Co., Inc.
 4. Flexicraft Industries.
 5. Flex-Weld, Inc.
 6. Hyspan Precision Products, Inc.
 7. Metraflex, Inc.
 8. Piping Technology & Products, Inc.
 9. Senior Flexonics, Inc.; Pathway Division
- B. Description: Alignment guides shall be constructed of steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

2.03 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
1. Stud: Threaded, zinc-coated carbon steel.
 2. Expansion Plug: Zinc-coated steel.
 3. Washer and Nut: Zinc-coated steel.
- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 3. Washer and Nut: Zinc-coated steel.
- F. Concrete: Portland cement mix, 3000 psi minimum. Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
- G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, 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

3.01 EXPANSION-JOINT INSTALLATION

- A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
- B. Install expansion joints of sizes matching size of piping in which they are installed.
- C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.02 PIPE BEND AND LOOP INSTALLATION

- A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Attach pipe bends and loops to anchors.
 1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.03 SWING CONNECTIONS

- A. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.04 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion fittings and loops.
- B. Attach guides to pipe and secure to building structure.

3.05 ANCHOR INSTALLATION

- A. 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.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION 22 18 21

SECTION 22 18 22
IN-LINE PIPE EXPANSION COMPENSATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies in-line piping expansion compensators and fitting materials and installation methods common to more than one section of Division 22 and includes basic piping expansion loop installation instructions. Portions of this Section may not be required in this project. Similarly, other items in the Section might be superseded by more specific requirements in other sections that detail specific systems. See drawings and each specific system description section of Division 22 for specific sizes, materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all piping work described in this Section.

1.03 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.
- C. Shop drawings shall contain the following information:
 - 1. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - 2. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - 3. Schedule: For manufactured in-line compensator units, indicate type, manufacturer's number, size, material, pressure rating, end connections, length of pipe, temperature differential, expansion/contraction range, and location for each in-line expansion.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
 - 2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS EXPANSION COMPENSATORS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide in-line type pipe expansion compensators as manufactured by one of the following:
 - 1. Hyspan
 - 2. Keflex
 - 3. Metraflex

2.02 IN-LINE EXPANSION COMPENSATORS:

- A. Expansion compensators shall be stainless steel bellows type constructed to protect against torsion, squirm, misalignment, overcompensation and external damage.
- B. The submittal schedule for in-line type expansion compensators shall include the specific location of each and the length of pipe, temperature differential and expansion/contraction length for which the expansion compensator is sized. The following temperature differentials shall be utilized for sizing in-line type expansion compensators:

Type of Pipe	Expansion/Contraction Temperature Differential (Degrees Fahrenheit)
Domestic Cold Water	100
Domestic Hot Water	200

2.03 ALIGNMENT GUIDES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide alignment guides as manufactured by one of the following:
 - 1. AdSCO Manufacturing, LLC.
 - 2. Advanced Thermal Systems, Inc.
 - 3. Flex-Hose Co., Inc.
 - 4. Flexicraft Industries.
 - 5. Flex-Weld, Inc.
 - 6. Hyspan Precision Products, Inc.
 - 7. Metraflex, Inc.
 - 8. Piping Technology & Products, Inc.
 - 9. Senior Flexonics, Inc.; Pathway Division
- B. Description: Alignment guides shall be constructed of steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

2.04 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Stud: Threaded, zinc-coated carbon steel.
 - 2. Expansion Plug: Zinc-coated steel.
 - 3. Washer and Nut: Zinc-coated steel.
- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.

3. Washer and Nut: Zinc-coated steel.
- F. Concrete: Portland cement mix, 3000 psi minimum. Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
- G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, 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

3.01 EXPANSION-JOINT INSTALLATION

- A. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
- B. Install expansion joints of sizes matching size of piping in which they are installed.
- C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.
- D. Install expansion compensators cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

3.02 SWING CONNECTIONS

- A. Connect risers and branch connections to hot water mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to hot water fixtures with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to hot water fixtures with at least four pipe fittings, including tee in main.

3.03 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion fittings and loops.
- B. Attach guides to pipe and secure to building structure.

3.04 ANCHOR INSTALLATION

- A. 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.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION 22 18 22

**SECTION 22 20 10
EQUIPMENT IDENTIFICATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies plumbing system equipment identification and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide identification as manufactured by one of the following:
 - 1. Brady Corporation
 - 2. Brimar Industries, Inc.
 - 3. Craftmark Identification Systems
 - 4. DuraLabel/Graphic Products
 - 5. Kolbi Pipe Marker Co.
 - 6. Marking Services, Inc.
 - 7. Seton Identification Products

2.02 EQUIPMENT NAMEPLATES

- A. Nameplates shall be laminated phenolic with black surface and white core. Use 1/16" thick material for plates up to 2" by 4". For larger sizes use 1/8" thick. Letters and numbers shall be a minimum of 1/2" high.

PART 3 EXECUTION

3.01 EQUIPMENT IDENTIFICATION

- A. Provide nameplates to identify all specified equipment with letters and numbers matching equipment designation as indicated on the drawings.
- B. Nameplates shall be fastened by use of stainless steel sheet metal screws.
- C. Where equipment does not have a location for mounting of a nameplate, provide a stencil identification.
 - 1. Stencils shall be made with a color which stands out against the equipment finish color. Stencils shall be a minimum of 2" high.
 - 2. Apply one coat of lacquer or varnish over the stencils for protection.
 - 3. Nameplates and stencils shall be applied after any field painting of equipment.
- D. Stencils shall be made with a color which stands out against the equipment finish color. Stencils shall be a minimum of 2" high.
- E. Apply one coat of lacquer or varnish over the stencils for protection.
- F. Nameplates and stencils shall be applied after any field painting of equipment.

END OF SECTION 22 20 10

**SECTION 22 20 20
EQUIPMENT INSULATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies insulation materials and installation methods common to more than one section of Division 22.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all insulation work described in this Section.

1.03 QUALITY ASSURANCE

- A. Installing contractor shall have at least 3 years successful installation experience on projects with mechanical insulation similar to that required for this project.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.
- C. Replace damaged insulation which cannot be satisfactorily repaired, including insulating with vapor barrier damaged and moisture-saturated insulation.
- D. The insulation installer shall advise the General Contractor as to requirements for protection of the insulation work during the remainder of the construction period (after the installation of insulation), to avoid damage and deterioration of the finished insulation work.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Unless otherwise noted, and subject to compliance with Specifications, provide insulation materials from the manufacturers specified below:
 - 1. Fiberglass Equipment Insulation
 - a. Owens Corning
 - b. Knauf
 - c. CertainTeed
 - d. Johns Manville
 - 2. Closed Cell Elastomeric Insulation
 - a. Insul-Tube
 - b. K-Flex USA
 - c. Nomaco Kflex

- d. Techlite Insulation
- e. Thermacel

2.02 GENERAL

- A. Provide all insulation materials (insulation, jackets, fitting covers, adhesives, cements, mastics, sealers and finishes) with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

2.03 FIBERGLASS EQUIPMENT INSULATION

- A. Factory applied all service jacket shall be white, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
- B. Insulate the following equipment with fiberglass equipment insulation with all-service jacket (thickness as indicated), having a density of 3.0 pounds per cubic foot.
- C. Apply the following fiberglass insulation thickness schedule to the pipe size and type:

Fiberglass Piping Insulation Thickness Schedule					
Pipe Type	Pipe Diameter				
	0 to 1"	1-1/4" to 2"	2-1/2" to 4"	5" and 6"	8" and above
Roof Drain Sumps	1"	1"	1"	1"	1"
Domestic Hot Water Storage Tanks	3"	3"	3"	3"	3"

2.04 CLOSED-CELL ELASTOMERIC

- A. Insulate the following piping and fittings with closed cell elastomeric insulation.
- B. Closed cell elastomeric pipe insulation shall comply with ASTM C 534 Type I.
- C. Refer to the following Pipe Insulation Thickness Schedule:

Closed-Cell Elastomeric Piping Insulation Thickness Schedule					
Pipe Type	Pipe Diameter				
	0 to 1"	1-1/4" to 2"	2-1/2" to 4"	5" and 6"	8" and above
Water Cooler Traps and Wastes	1/2"	1/2"	1/2"	1/2"	1/2"
Floor Drain Sumps Receiving Cooling Coil Condensate	1"	1"	1"	1"	1"

PART 3 EXECUTION

3.01 GENERAL

- A. Install insulation products according to manufacturer's printed instructions, in compliance with recognized industry standards and this specification.

- B. Install all insulation over clean dry surfaces. Insulation must be dry and in good condition. Wet or damaged insulation is not acceptable.
- C. Install all insulation only after the completion of system pressure tests and leakage tests and installation of heat trace.
- D. Install insulation materials with smooth even surfaces. Use full lengths of insulation where possible, only cut where necessary. Do not use cut pieces or scraps abutting each other.
- E. Repair existing equipment insulation where removed to make new connections, to add controls, or where damaged by new construction. Use same insulation as specified for new service.
- F. Where existing asbestos insulation is discovered or suspected notify the building Owner immediately so it can be removed under a separate asbestos removal contract.
- G. Install insulation materials with smooth and even surfaces. Rework all poorly fitted joints. Do not use joint sealer or mastic as filler for joint gaps and excessive voids resulting from poor workmanship. Apply using staggered joint method for multi-layer installations, applying each layer of insulation separately.
- H. Install insulation materials with smooth even surfaces. Use full lengths of insulation where possible, only cut where necessary. Do not use cut pieces or scraps abutting each other.
- I. Coat insulated surfaces without vapor barrier with a layer of insulating cement, troweled to a smooth and continuous surface. Fill in seams, broken edges, and depressions. Cover over wire mesh and joints with cement sufficiently thick to remove surface irregularities.
- J. Maintain the integrity of factory-applied vapor barrier jacketing on all insulation, protecting it against puncture, tears or other damage.
- K. For field-applied all-service vapor barrier jacketing, neatly fit and tightly secure. Lap seams 2 inches minimum. Seal all joints with adhesive. Tape with 3 inch matching pressure-sensitive tape or 3 inch glass fabric and mastic.
- L. Removable insulation: Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance as scheduled and as required for inspection such as vessel covers, fasteners, flanges, frames, etc.
- M. On hot equipment, do not insulate handholes, clean-outs, ASME stamps and manufacturers nameplates. Bevel and seal insulation edges at these locations. On cold equipment (to prevent condensation), provide removable insulation sections over these locations. Tag surfaces to indicate what is concealed.
- N. Miter rigid fiberglass equipment insulation to fit shape of equipment and secure in place with steel bands at 12 to 18 inches on center. Seal all joints with matching pressure sensitive joint sealing tape.

3.02 PROTECTION

- A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.
- B. The insulation installer shall advise the General and the Plumbing Contractor as to requirements for protection of the insulation work during the remainder of the construction period (after the installation of insulation), to avoid damage and deterioration of the finished insulation work.

END OF SECTION 22 20 20

**SECTION 22 24 20
RECIRCULATION PUMPS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. Extent of domestic recirculation pump work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. Provide all materials, equipment, labor, and supervision necessary to install and perform all work described in this section.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.
- B. HI Compliance: Design, manufacture, and install HVAC pumps in accordance with HI - "Hydraulic Institute Standards".
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- E. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.
- F. Circulators shall be UL Listed for indoor use and NSF Certified to NSF/ANSI 372.
- G. Design Criteria: The Drawings indicate sizes, profiles, connections, and dimensional requirements of plumbing pumps, and are based on the specific manufacturer types and models indicated. Pumps having equal performance characteristics by other named manufacturers may be considered, provided deviations in dimensions and profiles and efficiencies do not change the design concept or intended performance as judged by the Engineer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- B. Store pumps in dry location.
- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

- A. Subject to compliance with requirements provide recirculation pumps as manufactured by one of the following:
 - 1. Bell and Gossett
 - 2. Paco
 - 3. Taco
 - 4. Grundfos

2.02 HOT WATER CIRCULATING PUMPS

- A. Hot water circulating pumps shall be close-coupled, centrifugal inline style pumps.
- B. Domestic water circulators shall be constructed of low-lead bronze or stainless steel with dynamically and one-piece hydraulically balanced bronze impeller, suitable for use in domestic water systems.
- C. The circulator shall have a self-lubricating, maintenance free design with a field-serviceable and replaceable cartridge. The cartridge shall contain all the moving parts and no mechanical seal shall be required.
- D. The maximum working pressure shall be 125 psi, maximum fluid temperature of 220°F, and minimum fluid temperature of 40°F.
- E. Motor shall be resilient mounted, open-drip proof enclosure type. Single phase motors shall be furnished with built-in overload protection.

PART 3 EXECUTION

3.01 EXAMINATION

- A. All equipment shall be installed plumb and level, firmly anchored in locations indicated and in accordance with the equipment manufacturer's recommendations.
- B. All equipment shall be installed with adequate clearance provided for routine maintenance and servicing.
- C. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Electrical Wiring: Verify that electrical wiring installation is acceptable to equipment Installer.

3.02 PUMP INSTALLATION

- A. Comply with HI 1.4 HI 2.4. As applicable
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support inline pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install continuous-thread hanger rods and elastomeric hangers of sufficient size to support weight of in-line circulators.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pump to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps. Reduce piping only at pump.
- D. Install electrical connections for power, controls, and devices.

- E. Ground equipment according to Division 26 requirements.
- F. Connect wiring according to Division 26 requirements.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative for one (1) hour to train Owner's maintenance personnel to adjust, operate, and maintain plumbing pumps.

END OF SECTION 22 24 20

**SECTION 22 24 33
ELEVATOR PIT SUMP PUMPS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. Extent of pump work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. Provide all materials, equipment, labor, and supervision necessary to install and perform all work described in this section.

1.03 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages. Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loading, required clearances, and methods of assembly of components.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: Include in emergency, operation, and maintenance manuals-parts lists for each type of pump, control, and accessory; including "trouble-shooting" maintenance guide.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- D. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.
- E. Design Criteria: The Drawings indicate sizes, profiles, connections, and dimensional requirements of plumbing pumps, and are based on the specific manufacturer types and models indicated. Pumps having equal performance characteristics by other named manufacturers may be considered, provided deviations in dimensions and profiles and efficiencies do not change the design concept or intended performance as judged by the Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- B. Store pumps in dry location.
- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

1.06 COORDINATION

- A. Coordinate size and location of sumps with the General Contractor.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements provide plumbing pumps as manufactured by one of the following:
 - 1. Sump Pumps
 - a. Homa
 - b. Weil
 - c. Liberty
 - d. Zoeller

2.02 CONFIGURATION

- A. Sump Pumps shall be simplex, vertical, centrifugal, direct connected, end suction, single stage, bronze fitted, complete with integral inlet strainer, operating controls and sump cover.

2.03 CASING

- A. Epoxy coated class 30 cast iron with integral cast iron inlet strainer and legs to elevate the pump to permit flow into the impeller. Discharge companion flange shall be arranged for vertical discharge and suitable for plain-end pipe connection.

2.04 IMPELLER

- A. Statically and dynamically balanced, open or semi-open, overhung, single suction, fabricated from cast bronze conforming to ASTM B-584, keyed to shaft and secured by a locking cap screw.

2.05 MOTOR AND SHAFT

- A. Motor: Hermetically sealed, capacitor start, with built-in overload protection, with 10-foot, 3-conductor, waterproof cable and grounding plug.
- B. Pump and motor shaft stainless steel, with factory-sealed, grease-lubricated ball bearings.

2.06 SEALS

- A. Stainless steel carbon/ceramic.

2.07 BASIN

- A. Not a requirement.

2.08 CONTROLS

- A. Controls shall be located within a NEMA 3R alarm enclosure remote from the pump and shall contain a UL508 approved switch with 200 foot piggyback electrical supply cord and audible and light alarms with dry contacts. Controller and float switch shall alert maintenance personnel of high water conditions. Controller shall also prevent pump from starting when oil is detected and alert maintenance personnel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. All equipment shall be installed plumb and level, firmly anchored in locations indicated and in accordance with the equipment manufacturers recommendations.
- B. All equipment shall be installed with adequate clearance provided for routine maintenance and servicing.
- C. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Electrical Wiring: Verify that electrical wiring installation is acceptable to equipment Installer.
- F. Basins: Install sump basins in indicated locations and connect to drainage lines. Brace interior of basin in accordance with manufacturer's instructions to prevent distortion or collapse during concrete placement. Set cover over basin and fasten to top flange of basin install so cover is flush with finished floor.

3.02 PUMP INSTALLATION

- A. Comply with HI 1.4 HI 2.4. As applicable
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install continuous-thread hanger rods and elastomeric hangers of sufficient size to support weight of in-line circulators.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pump to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install check valve on discharge side of pumps.
- E. Install electrical connections for power, controls, and devices.
- F. Furnish, install, mount, and wire electrical control panel for sump pumps in designated room(s) as indicated.
- G. Ground equipment according to Division 26 requirements.
- H. Connect wiring according to Division 26 requirements.

3.04 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 6. Start motor.
 - 7. Open discharge valve slowly.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative for two (2) hours to train Owner's maintenance personnel to adjust, operate, and maintain plumbing pumps.

END OF SECTION 22 24 33

**SECTION 22 25 15
HYDRO PNEUMATIC PRESSURE TANKS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the materials and installation requirements for domestic water system pressure tanks.
- B. Furnish equipment, materials, labor and supervision necessary to provide and install reduced pressure backflow preventers.

1.03 CODES AND STANDARDS

- A. Tank shall comply with ASME code, section 8, Div 1, UG 90 C-2 requirements.

1.04 DELIVERY, STORAGE, HANDLING

- A. Store domestic water pressure tank on site or off site to avoid damage due to construction activity and weather.

1.05 SUBMITTALS

- A. Furnish submittals as required per section 22 01 10 "Project Submittal Requirements"

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide pressure tanks as manufactured by one of the following:
 - 1. Syncroflo
 - 2. Amtrol, Inc.
 - 3. Taco, Inc.
 - 4. Bell and Gossett ITT; Fluid Handling Div.

2.02 GENERAL

- A. Provide tanks of the size and type as indicated on the drawings.

2.03 CONSTRUCTION

- A. Bladder type tanks shall be designed, constructed and stamped in accordance with Section VIII, Division I of ASME Boiler and Pressure Vessel Code.

- B. Units shall be furnished with lifting rings, and have the system connection and charging valve at the tank top and tank drain connection at the bottom.
- C. Bladder shall be replaceable, constructed of heavy duty butyl, and shall be FDA approved.
- D. Tank shall be a 100% draw down design.
- E. The bladder shall be NB stamped for 125 psig and shall be rated for a maximum system operating temperature of 240°F.
- F. Furnish tanks with a steel base ring for vertical mounting.

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions where bladder type expansion tanks are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install expansion tanks on floor as indicated, in accordance with manufacturer's instructions.
- B. Vent and purge air from domestic water system
- C. Charge tank with proper air charge as recommended by manufacturer.

END OF SECTION 22 25 15

**SECTION 22 31 10
DOMESTIC WATER STORAGE VESSELS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies domestic hot water storage tanks and accessories, and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of storage tanks of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects with storage tank work similar to that required for project.

1.04 SPECIFIC CODES AND STANDARDS

- A. ASME Code Symbol Stamps: Comply with ASME Boiler and Pressure Vessel Code requirements for storage tank construction and stamp with ASME Code symbol requirements.
- B. AWWA Compliance: Comply with applicable requirements of American Water Works Association standards pertaining to steel water tanks.
- C. AGA/ANSI Compliance: Provide water storage tanks with temperature and pressure relief valves which are sized, listed, and labeled in accordance with ANSI/AGA Standard Z21.10.
- D. ASHRAE Compliance: Provide hot water storage tanks with insulation not less than prescribed in ASHRAE 90.1.

1.05 SUBMITTALS

- A. Furnish submittals as required per section 22 01 10 "Project Submittal Requirements"

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle water storage tanks and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged water storage tanks or components; remove from site and replace with new.
- B. Store water storage tanks and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading water storage tanks and moving units to final location for installation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide hot water storage tanks as manufactured by one of the following:
 - 1. Aerco
 - 2. A.O. Smith
 - 3. Bradford White
 - 4. Lochinvar

5. State Industries

2.02 GENERAL

- A. The storage tanks shall be of a vertical design and shall be constructed with an inner chamber baffle designed to receive all circulation to and from the water heater to eliminate turbulence in the tank.
- B. The baffled tank shall supply 80% of tank capacity without a drop in outlet temperature, regardless of rate of draw.
- C. The storage tank shall have a working pressure of 125 PSI.

2.03 CONSTRUCTION

- A. The storage tank shall be constructed in accordance with ASME Boiler and Pressure Vessel Code requirements - stamped and registered with the National Board of Boiler and Pressure Vessel Inspectors.
- B. The tank shall be furnished with all flanged connections as detailed on the drawings.
- C. The interior of the storage tank shall be glass lined and fired to 1600°F to ensure a molecular fusing of glass and steel, furnished with magnesium anodes and carry a five (5) year limited warranty.
- D. The storage tank shall be constructed with a heavy gauge galvanized steel jacket assembly, primed and pre-painted on both sides with a minimum dry film thickness of 0.70 mills. The storage tank shall be completely encased in minimum of 2" thick, high density polyurethane foam insulation to meet the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard.
- E. Storage tanks shall be furnished with a handhole, for ease of inspection, cleanout, and service.

2.04 ACCESSORIES

- A. Provide each storage tank with relief valve
- B. Provide with pressure gauge
- C. Provide tank with manual air vent.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which domestic water storage tanks are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION

- A. All equipment shall be installed plumb and level, firmly anchored in locations indicated and in accordance with the equipment manufacturers' recommendations.
- B. All equipment shall be installed with adequate clearance provided for routine maintenance and servicing.
- C. All indoor floor mounted equipment shall be located on a 4" high concrete housekeeping pad.

3.03 CONNECTIONS

- A. Make connections between water tank and domestic water piping with shut-off valves and unions or flanges as indicated.

3.04 FIELD QUALITY CONTROL

- A. Testing: Upon completion of installation, pressure test water tanks hydrostatically to assure structural integrity and freedom from leaks in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.
- B. Cleaning:

1. Flushing: Flush water tank upon completion of installation in accordance with manufacturer's instructions and comply with applicable health codes.

END OF SECTION 22 31 10

SECTION 22 40 10

VITREOUS CHINA FIXTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes plumbing fixtures, materials, and installation requirements.
- B. Extent of plumbing fixtures work required by this Section is indicated on drawings and schedules and by requirements of this Section.
- C. Furnish equipment, materials, labor, and supervision as required for complete installation of plumbing fixtures as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. Plumbing Fixture Standards: Comply with applicable portions of local plumbing codes pertaining to materials and installation of plumbing fixtures.
- B. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
- C. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
- D. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.
- E. Regulatory Requirements: Comply with requirements of the Americans with Disabilities Act (ADA) of 1990 with respect to plumbing fixture requirements for the physically handicapped; providing accessibility and usability for physically handicapped people.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Note – Some plumbing fixtures scheduled may include trim and accessories which are indicated by part of the scheduled model number.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 PLUMBING FIXTURES

- A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats and valves as shown by their published product information and indicated in the plumbing fixtures schedule; either as designed and constructed or as recommended by manufacturer and as required for complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of the same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

2.02 MATERIALS

- A. Unless otherwise specified, comply with applicable Federal Specification WW-P-541/-Series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541/specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps and vacuum breakers, even though some plumbing fixtures specified in this Section are not described in WW-P-541/-.
- B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, discoloration or other surface imperfections on finished units are not acceptable.
- C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
- D. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks, glaze exposed surfaces and test for crazing resistance in accordance with ASTM C554.

2.03 PLUMBING FITTINGS, TRIM AND ACCESSORIES

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves or dispensing devices of type and size indicated and as required to operate as indicated. Include manual shut-off valves (stops) and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems. Provide flow restricting orifice in faucets where restraint of flow is required.
- B. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment. Vacuum breakers shall be atmospheric or pressure type as required by piping arrangement and equipment being served. Type shall determine mounting height.
- C. Water Hammer Arrestors: Provide water hammer arrestors where shown on the drawings and as required to prevent water hammer and excessive vibration in the domestic water system. If concealed, provide an access door. Provide arrestors in water piping to all equipment having a valve that closes automatically when released manually or has a fast-action mechanical closure. Provide arrestors with shutoff ball valve to accommodate future replacement. Arrestors to be of size indicated or as recommended by the manufacturer.
- D. Carriers: Provide cast iron supports for fixtures of either graphitic gray iron, ductile iron or malleable iron as indicated.
- E. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- F. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated sheet steel escutcheons with friction slips.
- G. Aerators: Provide aerators as permitted by local health department. Note – aerators in health care facilities shall be laminar flow "Careguard" as manufactured by Neoperl.
- H. Comply with additional fixture requirements contained in fixture schedule on drawings. Note – Some plumbing fixtures scheduled may include trim accessories which are indicated by part of the scheduled model number.

2.04 VITREOUS CHINA FIXTURES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide vitreous china fixtures as manufactured by one of the following:
 - 1. American Standard
 - 2. Crane
 - 3. Eljer
 - 4. Kohler
 - 5. Sloan
 - 6. Zurn One

- B. Materials
 - 1. Provide fixtures constructed of vitreous china with all visible surfaces glazed.
 - 2. Provide water closets either floor or wall mounted, as indicated on the drawings.
 - 3. Provide water closets with either bottom or rear discharge as indicated on the drawings
 - 4. Provide wall mounted, back outlet, Siphon jet type, vitreous-china urinals with integral cast strainer.
 - 5. Provide lavatories as indicated on the drawings.
 - 6. Provide either floor or wall mounted clinic sinks as indicated on the drawings.

2.05 FLUSH VALVES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide flush valves as manufactured by one of the following:
 - 1. American Standard
 - 2. Delany
 - 3. Kohler
 - 4. Moen
 - 5. Sloan
 - 6. Zurn

- B. Manual flush valves shall have brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts. Internal design shall include diaphragm operation.

- C. Electronic Infrared Flush Valves
 - 1. Flush valve shall be diaphragm operated with a polished chrome plated finish.
 - 2. Furnish with multi-lobular infrared sensor, which shall detect both user presence and duration. Infrared sensor shall be range adjustable and also duration adjustable for field adjusting to avoid nuisance flushes.
 - 3. Flush valve shall be furnished with angle stop valve with back check protection, vandal resistant control stop cover, vacuum breaker, flush tube cover with wall flange, and fixture spud escutcheon.
 - 4. Unless indicated otherwise, sensors shall be battery operated, powered by four (4) AA batteries with a flashing "low battery" indicator light.

5. Where indicated on the drawings, furnish recessed mounted, hard wired 24 volt fixtures. Sensor and electronics shall be mounted in a 13" by 17" stainless steel wall box with vandal resistant torx style fasteners. Furnish with 120 volt to 24 volt power transformer.

2.06 FAUCETS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide faucets as manufactured by one of the following:
 1. American Standard
 2. Chicago Faucet Company
 3. Delta Commercial
 4. Kohler
 5. Moen Commercial
 6. T&S Brass
 7. Zurn Aquaspec
- B. General:
 1. Furnish faucets compatible with associated fixture, matching quantity and spacing of anchorages and supply piping with pre-fabricated fixture penetrations.
 2. Provide faucet outlets of types approved by the local Health Department.
 3. Note – Aerators in health care facilities shall be laminar flow "Careguard" as manufactured by Neoperl.
- C. Manual Faucets
 1. Provide faucets with polished chrome plated finished unless noted otherwise.
 2. Handles shall be ADA compliant when specified.
- D. Electronic Infrared Faucets
 1. Provide faucets with polished chrome plated finished unless noted otherwise.
 2. Furnish with multi-lobular infrared sensor, which shall detect both user presence and duration. Infrared sensor shall be range adjustable and also duration adjustable for field adjusting to avoid nuisance operations.
 3. Provide faucet outlets of types approved by the local Health Department.

2.07 WATER CLOSET SEATS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide water closet seats as manufactured by one of the following:
 1. American Standard
 2. Bemis
 3. Beneke
 4. Church
 5. Kohler
 6. Sloan
 7. Olsonite
- B. Materials

1. Seats shall be injection molded of high strength, impact, and chemical resistant plastic.
2. Bumpers shall be integrally molded into the seat.
3. Check hinges are to have stainless steel posts, washers, and nuts.
4. Color shall be white.

2.08 FIXTURE CARRIERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide fixture carriers as manufactured by one of the following:
 1. Josam
 2. J.R. Smith
 3. Tyler Pipe (Wade)
 4. Watts Drainage Products
 5. Zurn
- B. Materials
 1. Provide cast iron supports for fixtures of either graphitic gray iron or malleable iron. Provide carriers and supports as required for proper fixture installation.
 2. Type shall permit field adjustment to fit variations in construction.
 3. Adjustable face plate and wall-mounted urinal and closet supports shall be securely bolted to floor.
 4. Wall mounted lavatories shall be adjustable concealed arms with support carrier securely bolted to floor.
 5. Carriers shall be furnished at regular height or at ADA mounting height as scheduled on the drawings.

2.09 FIXTURES STOPS, SUPPLIES AND TRAPS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following:
 1. Brasscraft
 2. Engineered Brass Company
 3. McGuire Manufacturing Company, Inc.
- B. Materials
 1. Provide all stops, supplies, traps and escutcheons necessary for a complete installation.
 2. All components shall be chrome plated brass unless noted otherwise.
 - a. Stops shall be 1/4 turn brass ball volume, straight or angle type as required by the installation, with loose key, metal stem and washer cup with set screw washer retainer. Furnish with escutcheon.
 - b. Traps shall be 17 gauge chrome plated brass with clean-out plug. Furnish with slip nuts, wall bend and escutcheon.
 - c. Supplies shall be flexible chrome plated copper.

2.10 ADA INSULATION KITS

1. See Section 22 11 10.

B. Materials

1. Insulation kits shall be a minimum of 1/8" thick molded closed cell vinyl construction with PVC satin white cover. Insulation material shall be anti-microbial/anti fungal. Provide kit with removable valve access caps.
2. Units shall be barrier-free, and shall be installed per ADA requirements and shall comply with ICC/ANSI A 117.1.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION REQUIREMENTS

- A. Install all plumbing fixtures where shown on the drawings, at the indicated heights. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings and with recognized industry practices.
- B. Where required, install fixtures in compliance with the requirements of The Americans with Disabilities Act. For handicapped accessible water closets, mount flush valve handle on the access side of the fixture.
- C. Install all fixture carriers and supports in accordance with manufacturers published instructions. Securely fasten carriers and supports to the building structure.
- D. Install all fixtures square with wall, level and plumb. Secure all traps, stops and supplies to prevent any movement.
- E. Install all stops, supplies, traps and escutcheons as required for a complete installation. Locate all fixture stops immediately below the fixture. Nipples between copper piping and fixtures stops shall be brass, not galvanized steel. Where exposed, nipples shall be chrome plated.
- F. Seal space between plumbing fixtures and wall or floor with white silicone sealant to provide a watertight installation.
- G. Protect installed plumbing fixtures from damage until construction is completed and accepted by Owner. Remove protective covering when ready for use.

3.03 DELIVERY, STORAGE, HANDLING, PROTECTION

- A. Store all fixtures and materials on site or off site to avoid damage due to construction activity and weather.
- B. Provide protective covering for installed fixtures and trim.
- C. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures, replace and return damaged units to equipment manufacturer.
- D. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Architect.

3.04 CONNECTIONS

- A. Make final cold and hot water connections and provide necessary piping, materials and fittings for a complete installation.

- B. Make final drain and vent connections and provide necessary piping, materials and fittings for a complete installation.

3.05 CLEANING

- A. Remove all fixture labels and clean all fixtures to remove stains.

3.06 TESTING AND ADJUSTING

- A. Adjust all flush valves and other fixture water supplies to provide proper water flow.
- B. Adjust electronic infrared sensor detection range and duration limits for proper fixture operation and to avoid nuisance activation.

END OF SECTION 22 40 10

SECTION 22 40 11 WATER CLOSETS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes water closets, materials, and installation requirements.
- B. Extent of work required by this Section is indicated on drawings and schedules and by requirements of this Section.
- C. Furnish equipment, materials, labor, and supervision as required for complete installation of plumbing fixtures as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
- B. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
- C. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.
- D. Regulatory Requirements: Comply with requirements of the Americans with Disabilities Act (ADA) of 1990 with respect to plumbing fixture requirements for the physically handicapped; providing accessibility and usability for physically handicapped people.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide vitreous china fixtures as manufactured by one of the following:
 - 1. American Standard
 - 2. Crane
 - 3. Eljer
 - 4. Kohler
 - 5. Sloan
 - 6. Zurn One

2.02 GENERAL

- A. Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats and valves as shown by their published product information and indicated in the plumbing fixtures schedule; either as designed and constructed or as recommended by manufacturer and as required for complete installation.
- B. All fixtures of same type must be furnished by a single manufacturer.
- C. Unless otherwise specified, comply with applicable Federal Specification WW-P-541/- series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541/- specification relative to quality of ware, glazing, enamel, and composition and finish of metals; even though some plumbing fixtures specified in this Section are not described in WW-P-541/-
- D. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, discoloration or other surface imperfections on finished units are not acceptable.
- E. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

2.03 MATERIALS

- A. Provide fixtures constructed of vitreous china with all visible surfaces glazed.
- B. Finish shall be high quality, free from fire cracks, spots, blisters, pinholes and specks, glaze exposed surfaces and test for crazing resistance in accordance with ASTM C554.
- C. Provide water closets either floor or wall mounted and either bottom or rear discharge, as indicated on the drawings
- D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

2.04 FLUSH VALVES

- A. See fixture schedule. Water closet is tank type.

2.05 SEATS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide water closet seats as manufactured by one of the following:
 - 1. American Standard
 - 2. Bemis
 - 3. Beneke
 - 4. Church
 - 5. Kohler
 - 6. Sloan
 - 7. Olsonite
- B. Materials
 - 1. Seats shall be injection molded of high strength, impact, and chemical resistant plastic.
 - 2. Bumpers shall be integrally molded into the seat.
 - 3. Check hinges are to have stainless steel posts, washers, and nuts.
 - 4. Color shall be white.

2.06 FIXTURE CARRIERS

- A. Water closet is floor mounted, not applicable.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION REQUIREMENTS

- A. Install all plumbing fixtures where shown on the drawings, at the indicated heights. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings and with recognized industry practices.
- B. Where required, install fixtures in compliance with the requirements of The Americans with Disabilities Act. For handicapped accessible water closets, mount flush valve handle on the access side of the fixture.
- C. Install all fixture carriers and supports in accordance with manufacturers published instructions. Securely fasten carriers and supports to the building structure.
- D. Install all fixtures square with wall, level and plumb. Secure all traps, stops and supplies to prevent any movement.
- E. Install all stops, supplies, and escutcheons as required for a complete installation. Locate all fixture stops immediately below the fixture. Nipples between copper piping and fixtures stops shall be brass, not galvanized steel. Where exposed, nipples shall be chrome plated.
- F. Seal space between plumbing fixtures and wall or floor with white silicone sealant to provide a watertight installation.
- G. Protect installed plumbing fixtures from damaged until construction is completed and accepted by Owner. Remove protective covering when ready for use.

3.03 DELIVERY, STORAGE, HANDLING, PROTECTION

- A. Store all fixtures and materials on site or off site to avoid damage due to construction activity and weather. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.
- B. Provide protective covering for installed fixtures and trim.
- C. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures, replace and return damaged units to equipment manufacturer.
- D. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Architect.

3.04 CONNECTIONS

- A. Make final cold water connections and provide necessary piping, materials and fittings for a complete installation.
- B. Make final drain and vent connections and provide necessary piping, materials and fittings for a complete installation.

3.05 CLEANING

- A. Remove all fixture labels and clean all fixtures to remove stains.

3.06 TESTING AND ADJUSTING

- A. Adjust all flush valves and other fixture water supplies to provide proper water flow.
- B. Adjust electronic infrared sensor detection range and duration limits for proper fixture operation and to avoid nuisance activation.

END OF SECTION 22 40 11

**SECTION 22 40 14
LAVATORIES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes lavatories, materials, and installation requirements.
- B. Extent of plumbing fixtures work required by this Section is indicated on drawings and schedules and by requirements of this Section.
- C. Furnish equipment, materials, labor, and supervision as required for complete installation of plumbing fixtures as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
- B. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
- C. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.
- D. Regulatory Requirements: Comply with requirements of the Americans with Disabilities Act (ADA) of 1990 with respect to plumbing fixture requirements for the physically handicapped; providing accessibility and usability for physically handicapped people.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide vitreous china fixtures as manufactured by one of the following:
 - 1. American Standard
 - 2. Crane
 - 3. Eljer
 - 4. Sloan
 - 5. Kohler

2.02 GENERAL

- A. Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim and valves as shown by their published product information and indicated in the plumbing fixtures schedule; either as designed and constructed or as recommended by manufacturer and as required for complete installation.
- B. All fixtures of same type must be furnished by a single manufacturer.
- C. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
- D. Unless otherwise specified, comply with applicable Federal Specification WW-P-541/- series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541/- specification relative to quality of ware, glazing, enamel, and composition and finish of metals; even though some plumbing fixtures specified in this Section are not described in WW-P-541/-
- E. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

2.03 MATERIALS

- A. Provide fixtures constructed of vitreous china with all visible surfaces glazed.
- B. Finish shall be high quality, free from fire cracks, spots, blisters, pinholes and specks, glaze exposed surfaces and test for crazing resistance in accordance with ASTM C554.
- C. Provide lavatories either wall mounted (with a carrier), under-counter mount or drop-in countertop mounted, as indicated on the drawings and schedules.

2.04 FAUCETS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide faucets as manufactured by one of the following:
 - 1. American Standard
 - 2. Chicago Faucet Company
 - 3. Delta Commercial
 - 4. Kohler
 - 5. Moen Commercial
 - 6. T+S Brass
 - 7. Zurn Aquaspec
- B. General:
 - 1. Furnish faucets compatible with associated fixture, matching quantity and spacing of anchorages and supply piping with pre-fabricated fixture penetrations.
 - 2. Provide faucet outlets of types approved by the local Health Department.
 - 3. Note – Aerators in health care facilities shall be laminar flow "Careguard" as manufactured by Neoperl.
- C. Manual Faucets
 - 1. Provide faucets with polished chrome plated finished unless noted otherwise.
 - 2. Handles shall be ADA compliant when specified.
- D. Electronic Infrared Faucets
 - 1. Provide faucets with polished chrome plated finished unless noted otherwise.
 - 2. Furnish with multi-lobular infrared sensor, which shall detect both user presence and duration. Infrared sensor shall be range adjustable and also duration adjustable for field adjusting to avoid nuisance operations.

3. Provide flow restricting orifice in faucets where restraint of flow is required.
- E. Escutcheons
1. Chrome-plated sheet steel with friction slips.
- F. Comply with additional fixture requirements contained in fixture schedule on drawings.

2.05 FIXTURE CARRIERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide fixture carriers as manufactured by one of the following:
1. JOSAM
 2. J.R. Smith
 3. Tyler Pipe (Wade)
 4. Watts Drainage Products
 5. Zurn
- B. Materials
1. Provide cast iron supports for wall-hung fixtures of either graphitic gray iron, ductile iron or malleable iron as indicated. Provide carriers and supports as required for proper fixture installation.
 2. Type shall permit field adjustment to fit variations in construction.
 3. Wall mounted lavatories shall have adjustable concealed arms with support carrier securely bolted to floor.
 4. Carriers shall be furnished at regular height or at ADA mounting height as scheduled on the drawings.

2.06 FIXTURES, SUPPLIES, STOPS AND TRAPS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following:
1. Brasscraft
 2. Engineered Brass Company
 3. McGuire Manufacturing Company, Inc.
- B. Materials
1. All components shall be chrome plated brass unless noted otherwise.
 - a. Stops shall be 1/4 turn brass ball volume, straight or angle type as required by the installation, with loose key, metal stem and washer cup with set screw washer retainer. Furnish with escutcheon.
 - b. Traps shall be 17 gauge chrome plated brass with clean-out plug. Furnish with slip nuts, wall bend and escutcheon.
 - c. Supplies shall be flexible chrome plated copper.

2.07 ADA INSULATION KITS

- A. See Section 22 11 10.
- B. Materials
1. Insulation kits shall be a minimum of 1/8" thick molded closed cell vinyl construction with PVC satin white cover. Insulation material shall be anti-microbial/ anti fungal. Provide kit with removable valve access caps.

2. Units shall be barrier-free, and shall be installed per ADA requirements and shall comply with ICC/ANSI A 117.1.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install all plumbing fixtures where shown on the drawings, at the indicated heights. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings and with recognized industry practices.
- B. Where required, install fixtures in compliance with the requirements of The Americans with Disabilities Act. Provide ADA insulation kits on waste and water supply piping where required for compliance.
- C. Install all fixture carriers and supports in accordance with manufacturers published instructions. Securely fasten carriers and supports to the building structure.
- D. Install all fixtures square with wall, level and plumb. Secure all traps, stops and supplies to prevent any movement.
- E. Install all stops, supplies, traps and escutcheons as required for a complete installation. Locate all fixture stops immediately below the fixture. Nipples between copper piping and fixtures stops shall be brass, not galvanized steel. Where exposed, nipples shall be chrome plated.
- F. Seal space between plumbing fixtures and wall with white silicone sealant to provide a watertight installation.
- G. Protect installed plumbing fixtures from damaged until construction is completed and accepted by Owner. Remove protective covering when ready for use.

3.03 DELIVERY, STORAGE, HANDLING, PROTECTION

- A. Store all fixtures and materials on site or off site to avoid damage due to construction activity and weather.
- B. Deliver plumbing fixtures individually wrapped in factory-fabricated containers. Provide protective covering for installed fixtures and trim.
- C. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures, replace and return damaged units to equipment manufacturer.
- D. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Architect.

3.04 CONNECTIONS

- A. Make final cold and hot water connections and provide necessary piping, materials and fittings for a complete installation.
- B. Make final drain and vent connections and provide necessary piping, materials and fittings for a complete installation.

3.05 CLEANING

- A. Remove all fixture labels and clean all fixtures to remove stains.

3.06 TESTING AND ADJUSTING

- A. Adjust all faucets and other fixture water supplies to provide proper water flow.
- B. Adjust electronic infrared sensor detection range and duration limits for proper fixture operation and to avoid nuisance activation.

END OF SECTION 22 40 14

**SECTION 22 40 20
STAINLESS STEEL SINKS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes stainless steel sinks, materials, and installation requirements.
- B. Extent of plumbing fixtures work required by this Section is indicated on drawings and schedules and by requirements of this Section.
- C. Furnish equipment, materials, labor, and supervision as required for complete installation of plumbing fixtures as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
- B. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
- C. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.
- D. Regulatory Requirements: Comply with requirements of the Americans with Disabilities Act (ADA) of 1990 with respect to plumbing fixture requirements for the physically handicapped; providing accessibility and usability for physically handicapped people.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide stainless steel sinks as manufactured by one of the following:
 - 1. Elkay
 - 2. Just

2.02 GENERAL

- A. Provide factory-fabricated fixtures of type, style and material indicated.

- B. For each type fixture, provide fixture manufacturer's standard trim as shown by their published product information and indicated in the plumbing fixtures schedule; either as designed and constructed or as recommended by manufacturer and as required for complete installation.
- C. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer.

2.03 SINKS

- A. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, stains, discoloration or other surface imperfections on finished units are not acceptable.
- B. Sinks shall be minimum 18 gauge stainless steel ASTM A167, Type 302/304, hard workable temper, under counter mount or self rimming, and fully undercoated for sound proofing.
- C. Stainless steel sinks shall have a No. 4 satin finish directional polished in exposed surfaces, unless noted otherwise.

2.04 ACCESSORIES

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves or dispensing devices of type and size indicated and as required to operate as indicated. Include manual shut-off valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems. Provide flow restricting orifice in faucets where restraint of flow is required.
- B. P-Traps: Include removable P-traps (with clean out plug) where drains are indicated for direct connection to drainage system.
- C. Comply with additional fixture requirements contained in fixture schedule on drawings.

2.05 FAUCETS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide faucets as manufactured by one of the following:
 - 1. American Standard
 - 2. Chicago Faucet Company
 - 3. Delta Commercial
 - 4. Kohler
 - 5. Moen Commercial
 - 6. T&S Brass
 - 7. Zurn Aquaspec
- B. General:
 - 1. Furnish faucets compatible with associated fixture, matching quantity and spacing of anchorages and supply piping with pre-fabricated fixture penetrations.
 - 2. Provide faucet outlets of types approved by the local Health Department.
 - 3. Note – Aerators in health care facilities shall be laminar flow "Careguard" as manufactured by Neoperl.
- C. Manual Faucets
 - 1. Provide faucets with polished chrome plated finished unless noted otherwise.
 - 2. Handles shall be ADA compliant when specified.
- D. Electronic Infrared Faucets
 - 1. Provide faucets with polished chrome plated finished unless noted otherwise.

2. Furnish with multi-lobular infrared sensor, which shall detect both user presence and duration. Infrared sensor shall be range adjustable and also duration adjustable for field adjusting to avoid nuisance operations.
3. Provide faucet outlets of types scheduled and approved by the local Health department.

2.06 FIXTURES, SUPPLIES, STOP AND TRAPS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following:
 1. Brasscraft
 2. Engineered Brass Company
 3. McGuire Manufacturing Company, Inc.
- B. Materials
 1. All components shall be chrome plated brass unless noted otherwise.
 - a. Stops shall be ¼ turn brass ball valve, straight or angle type as required by the installation, with loose key, metal stem and washer cup with set screw washer retainer. Furnish with escutcheon.
 - b. Traps shall be 17 gauge chrome plated brass with clean-out plug. Furnish with slip nuts, wall bend and escutcheon.
 - c. Supplies shall be flexible chrome plated copper.

2.07 ADA INSULATION KITS

- A. See Section 22 11 10.
- B. Materials
 1. Insulation kits shall be a minimum of 1/8" thick molded closed cell vinyl construction with PVC satin white cover. Insulation material shall be antimicrobial/anti fungal. Provide kit with removable valve access caps.
 2. Units shall be barrier-free, and shall be installed per ADA requirements and shall comply with ICC/ANSI A 117.1.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION REQUIREMENTS

- A. Install all plumbing fixtures where shown on the drawings, at the indicated heights. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings and with recognized industry practices.
- B. Where required, install fixtures in compliance with the requirements of The Americans with Disabilities Act. For handicapped accessible water closets, mount flush valve handle on the access side of the fixture.

- C. Install all fixture supports in accordance with manufacturers published instructions. Securely fasten carriers and supports to the building structure.
- D. Install all fixtures square with wall, level and plumb. Secure all traps, stops and supplies to prevent any movement.
- E. Install all stops, supplies, traps and escutcheons as required for a complete installation. Locate all fixture stops immediately below the fixture. Nipples between copper piping and fixtures stops shall be brass, not galvanized steel. Where exposed, nipples shall be chrome plated.
- F. Seal space between countertop and fixture rim with silicone sealant to provide a watertight installation.
- G. Protect installed plumbing fixtures from damaged until construction is completed and accepted by Owner. Remove protective covering when ready for use.

3.03 DELIVERY, STORAGE, HANDLING, PROTECTION

- A. Store all fixtures and materials on site or off site to avoid damage due to construction activity and weather.
- B. Provide protective covering for installed fixtures and trim.
- C. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Architect.

3.04 CONNECTIONS

- A. Make final cold and hot water connections and provide necessary piping, materials and fittings for a complete installation.
- B. Make final drain and vent connections and provide necessary piping, materials and fittings for a complete installation.

3.05 CLEANING

- A. Remove all fixture labels and clean all fixtures to remove stains.

3.06 STARTUP, TESTING AND ADJUSTING

- A. Adjust all fixture water supplies to provide proper water flow.
- B. Adjust electronic infrared sensor detection range and duration limits for proper fixture operation and to avoid nuisance activation.

END OF SECTION 22 40 20

**SECTION 22 40 21
GARBAGE DISPOSALS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes garbage disposals, materials, and installation requirements.
 - 1. Extent of plumbing fixtures work required by this Section is indicated on drawings and schedules and by requirements of this Section.
- B. Furnish equipment, materials, labor, and supervision as required for complete installation of garbage disposals as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of garbage disposals of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. UL Compliance:

1.05 SUBMITTALS

- A. Provide Shop Drawings for each mark of plumbing fixture.
- B. Operation and Maintenance Manuals

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.
- B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures, replace and return damaged units to equipment manufacturer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. InSinkErator, a division of Emerson Electric Co.
 - 2. Waste King
 - 3. Franke

2.02 FEATURES

- A. Furnish quantity, size, horsepower, and voltage as indicated on the drawings.
- B. Furnish with stainless steel grind chamber and internal components
- C. Furnish with single phase motor, of size as indicated on the drawings
- D. Furnish with cord with plug end
- E. Furnish with anti-vibration drain connection fitting and unit mount

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION REQUIREMENTS

- A. Install all plumbing fixtures where shown on the drawings, at the indicated heights. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings and with recognized industry practices.
- B. Where required, install fixtures in compliance with the requirements of The Americans with Disabilities Act. For handicapped accessible water closets, mount flush valve handle on the access side of the fixture.
- C. Install all fixture carriers and supports in accordance with manufacturers published instructions. Securely fasten carriers and supports to the building structure.
- D. Install all fixtures square with wall, level and plumb. Secure all traps, stops and supplies to prevent any movement.
- E. Install all stops, supplies, traps and escutcheons as required for a complete installation. Locate all fixture stops immediately below the fixture. Nipples between copper piping and fixtures stops shall be brass, not galvanized steel. Where exposed, nipples shall be chrome plated.
- F. Seal space between plumbing fixtures and wall or floor with white silicone sealant to provide a watertight installation.
- G. Protect installed plumbing fixtures from damaged until construction is completed and accepted by Owner. Remove protective covering when ready for use.
- H. Provide all stops, supplies, traps and escutcheons necessary for a complete installation.

3.03 DELIVERY, STORAGE, HANDLING, PROTECTION

- A. Store all fixtures and materials on site or off site to avoid damage due to construction activity and weather.
- B. Provide protective covering for installed fixtures and trim.
- C. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Architect.

3.04 CONNECTIONS

- A. Make final cold and hot water connections and provide necessary piping, materials and fittings for a complete installation.
- B. Make final drain and vent connections and provide necessary piping, materials and fittings for a complete installation.

3.05 CLEANING

- A. Remove all fixture labels and clean all fixtures to remove stains.

3.06 STARTUP, TESTING AND ADJUSTING

- A. Adjust all flush valves and other fixture water supplies to provide proper water flow.
- B. Adjust electronic infrared sensor detection range and duration limits for proper fixture operation and to avoid nuisance activation.

END OF SECTION 22 40 21

**SECTION 22 40 60
SHOWERS (ACRYLIC/ONE PIECE)**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes showers, materials, and installation requirements.
- B. Extent of plumbing fixtures work required by this Section is indicated on drawings and schedules and by requirements of this Section.
- C. Furnish equipment, materials, labor, and supervision as required for complete installation of plumbing fixtures as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
- B. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
- C. Federal Standards: Comply with applicable FS WW-P-541/-Series sections pertaining to plumbing fixtures.
- D. Regulatory Requirements: Comply with requirements of the Americans with Disabilities Act (ADA) of 1990 with respect to plumbing fixture requirements for the physically handicapped; providing accessibility and usability for physically handicapped people.
- E. Showers shall meet or exceed physical and performance requirements cast acrylic fixtures (ANSI Z124.2). Standing/walking surfaces shall meet slip-resistance requirements of consumer Safety Specification ASTM F-462, with static friction coefficient no less than 0.04.
- F. Showers shall have a flame spread rating of 25 or less (ASTM E-84; E-162); smoke density rating of 450 or less (E-84); equal to Class A, NFPA.
- G. Showers shall bear or have affixed to them a molded manufacturer's identification logo and/or permanent label showing manufacturer's name and model number and the seal of the Uniform Plumbing Code and shall be accompanied by detailed installation recommendations.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 Acceptable Manufacturers: Subject to compliance with requirements, provide showers as manufactured by one of the following:

- A. Aqua Bath
- B. Sterling

- C. Swanstone
- D. Clarion

2.02 GENERAL

- A. Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats and valves as shown by their published product information and indicated in the plumbing fixtures schedule; either as designed and constructed or as recommended by manufacturer and as required for complete installation.
- B. All fixtures of same type must be furnished by a single manufacturer.
- C. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, holes, stains, discoloration or other surface imperfections on finished units are not acceptable.
- D. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

2.03 SHOWERS

- A. Provide showers consisting of one piece surround and base constructed of cast acrylic with 3/4" threshold.
- B. Where indicated, units shall be barrier-free, and shall be installed per ADA requirements.
- C. Provide showers with wheelchair transfer seat conforming to ADA accessibility standards. Handicapped grab bars shall be nom. 1-1/2" O.D. and support a minimum load of 250 lbs. in accordance with the Consumer Safety Specifications ASTM F-446 and ANSI A117.1 guidelines.

2.04 SHOWER VALVES

- A. Available Manufacturers: Subject to compliance with requirements. Provide shower valves as manufactured by one of the following:
 - 1. Leonard Valve Company.
 - 2. Powers; a Watts Industries Co.
 - 3. Watts Industries, Inc.; Water Products Div.
 - 4. Zurn Plumbing Products Group; Wilkins Div.
 - 5. Symmons
- B. Standard: ASSE 1016, thermostatically controlled water tempering valve.
- C. Pressure Rating: 125 psig minimum, unless otherwise indicated.
- D. Body: Lead free bronze body with corrosion-resistant interior components.
- E. Temperature Control: Adjustable.
- F. Inlets and Outlet: Threaded.
- G. Finish: Rough or chrome-plated bronze.
- H. Tempered-Water Setting: minimum 110 deg F. and maximum 120 deg F.

2.05 ACCESSORIES

- A. Hand wand with hose: Furnish with chrome plated hand wand with five foot flexible metal hose, inline vacuum breaker, and wall connection with flange.
- B. Slide bar: Furnish with 30" long chrome plated slide bar for mounting of the hand wand shower head.
- C. Furnish with fold-up, L-shaped seat with cushion.

- D. Provide each shower with 1" O.D. satin finish stainless steel curtain rod, satin finish stainless steel grab bar on wet wall and on side wall, one soap dish.

2.06 DRAIN

- A. See plumbing drains and fittings section of specification for associated drain.
- B. Drain strainer shall be constructed of stainless steel, unless scheduled otherwise.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION REQUIREMENTS

- A. Install all plumbing fixtures where shown on the drawings, or as recommended by the manufacturer. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings and with recognized industry practices.
- B. Where required, install fixtures in compliance with the requirements of The Americans with Disabilities Act.
- C. Install all fixture supports in accordance with manufacturers published instructions. Securely fasten carriers and supports to the building structure.
- D. Install all fixtures square with wall, level and plumb. Secure all supplies to prevent any movement.
- E. Install all supplies and escutcheons as required for a complete installation. Locate all fixture stops immediately below the fixture.
- F. Protect installed plumbing fixtures from damaged until construction is completed and accepted by Owner. Remove protective covering when ready for use.

3.03 DELIVERY, STORAGE, HANDLING, PROTECTION

- A. Store all fixtures and materials on site or off site to avoid damage due to construction activity and weather.
- B. Provide protective covering for installed fixtures and trim.
- C. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Architect.

3.04 CONNECTIONS

- A. Make final cold and hot water connections and provide necessary piping, materials and fittings for a complete installation.
- B. Make final drain and vent connections and provide necessary piping, materials and fittings for a complete installation.

3.05 CLEANING

- A. Remove all fixture labels and clean all fixtures to remove stains.

3.06 STARTUP, TESTING AND ADJUSTING

- A. Adjust shower valves to provide maximum 120 degree Fahrenheit water at shower nozzle, when turned to full hot.

END OF SECTION 22 40 60

**SECTION 22 41 10
DRAINS AND TRAP PRIMERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies drains and trap primers and includes materials, testing and installation methods.
- B. The extent of plumbing work required by this Section is indicated on the drawings and schedules and by requirements of this Section.
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. All plumbing systems shall comply with the Local Plumbing Code and all requirements of the local authority having jurisdiction.
- B. Plumbing systems shall comply with ANSI, ASPE, ASSE, ASTM, CSA, NSF, and AWWA requirements.
- C. Trap seal primers shall comply with ASSE 1018.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver drains and trap primers individually wrapped in factory-fabricated containers.
- B. Handle drains and trap primers carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures, replace and return damaged units to equipment manufacturer.

1.06 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

- A. Acceptable manufacturers: Subject to compliance with requirements, provide drains as manufactured by one of the following:
 - 1. Zurn Industries Inc.
 - 2. J.R. Smith
 - 3. Wade
 - 4. Josam.
- B. Provide all floor drains with "P" traps with trap primer connection. Furnish all traps 3 inch diameter or less, installed above grade, with clean-out plugs.

- C. Provide strainer size and style as indicated on the drawings.
- D. Provide models with recessed buckets or sediment traps as indicated on the drawings.

2.02 TRAP SEALS

- A. Acceptable manufacturers; Subject to compliance with requirements, provide trap guards as manufacturer by one of the following:
 - 1. J.R. Smith
 - 2. Pro Vent Systems
 - 3. ProSet Systems
- B. Furnish trap guard IAPMO and ASSE listed
- C. Trap guard shall insert into the floor drain body and shall close off the trap when the drain is not in use to minimize evaporative loss of trap seal fluid.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install trap primer valves to maintain water in traps and to prevent back-siphonage of sewer gases through the drains. Piping from trap primer valve/distribution unit to floor drains serving equipment (water heaters, etc.) can be above floor for short distances (3' maximum) if it does not interfere with access to and servicing of equipment.

3.02 CONNECTIONS

- A. Trap Primers
 - 1. Coordinate piping connection size and style with domestic cold water piping.
 - 2. Tie into dedicated connection hub on drain or fixture trap. Coordinate traps requiring trap primers to provide necessary connection hubs where required.

3.03 TESTING

- A. All fittings installed in the domestic water piping system shall be subjected to the same system integrity verification testing as the piping. See the domestic water piping specification section for processes and procedures.
- B. All fittings and drains installed in the sanitary, storm and vent piping systems shall be subjected to the same system integrity verification testing as the piping. See the sanitary, storm and vent piping specification section for processes and procedures.

3.04 FIELD QUALITY CONTROL

- A. Upon completion of installation of Plumbing Specialties and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements.
- B. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 22 41 10

**SECTION 22 42 10
HOSE BIBBS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies hose bibbs and includes materials, testing and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. All plumbing systems shall comply with the Local Plumbing Code and all requirements of the local authority having jurisdiction.
- B. Plumbing systems shall comply with ANSI, ASPE, ASSE, ASTM, CSA, NSF, and AWWA requirements.
- C. Vacuum breakers, hose bibbs, and wall hydrants shall comply with ASSE Standard 1019.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver drains and trap primers individually wrapped in factory-fabricated containers.
- B. Handle drains and trap primers carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures, replace and return damaged units to equipment manufacturer.

1.06 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 EXTERIOR HOSE BIBBS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide wall hydrants as manufactured by one of the following:
 - 1. Smith (Jay R.) Company
 - 2. Watts Drainage Products
 - 3. Zurn Industries, Inc.; Hydromechanics Division
- B. Exterior, non-freeze design with valve remotely mounted inside the heated portion of the building.
- C. Furnish with bronze valve body and stainless steel face.
- D. Furnish with quarter turn, removable "T" handle.
- E. Furnish with integral vacuum breaker and integral dual check valve.

- F. Furnish valve meeting ANSI A112.21.3M specifications, and complying with ASSE 1019-B, 1052 and 1053.

2.02 INTERIOR HOSE BIBS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide wall hydrants as manufactured by one of the following:
 - 1. Zurn Industries, Inc.
 - 2. J.R. Smith
 - 3. Wade.
 - 4. Chicago Faucet.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all units may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 CONNECTIONS

- A. Exterior Hose Bibbs:
 - 1. Coordinate wall thickness with General Contractor for determination of valve stem length.
 - 2. Coordinate piping connection size and style with domestic cold water piping.
 - 3. Coordinate exterior wall opening size with General Contractor.
- B. Interior Hose Bibbs
 - 1. Coordinate piping connection size and style with domestic cold water piping.
- C. Installation: provide vacuum breakers on all threaded hose bib connections.

3.03 TESTING

- A. All fittings installed in the domestic water piping system shall be subjected to the same system integrity verification testing as the piping. See the domestic water piping specification section for processes and procedures.
- B. All fittings and drains installed in the sanitary, storm and vent piping systems shall be subjected to the same system integrity verification testing as the piping. See the sanitary, storm and vent piping specification section for processes and procedures.

3.04 DISINFECTION

- A. Components installed in the domestic water piping system shall be subjected to the same chlorination process as the piping. See the domestic water piping specification section for processes and procedures.
- B. Verify components and internal parts of all fittings subjected to system chlorination are compatible with the chemicals used in the chlorination process.

3.05 FIELD QUALITY CONTROL

- A. Upon completion of installation of Plumbing Specialties and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements.

- B. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit sand proceed with retesting.

END OF SECTION 22 42 10

**SECTION 22 42 12
NON-FREEZE WALL HYDRANTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies non-freeze exterior wall mounted water distribution hydrants and includes materials, testing and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. Plumbing systems shall comply with ASPE, ASSE and AWWA requirements.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Include final Engineer approved copy of the shop drawing in the O&M manual, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide wall hydrants as manufactured by one of the following:
 - 1. Smith (Jay R.) Company
 - 2. Watts Drainage Products
 - 3. Zurn Industries, Inc.; Hydromechanics Division

2.02 GENERAL

- A. Exterior hydrants shall be of non-freeze design with valve remotely mounted inside the heated portion of the building.

2.03 CONSTRUCTION

- A. Furnish valve meeting ANSI A112.21.3M specifications, and complying with ASSE 1019-B, 1052 and 1053.
- B. Furnish with bronze valve body and stainless steel face.

2.04 ACCESSORIES

- A. Furnish with quarter turn, removable "T" handle.
- B. Furnish with integral vacuum breaker and integral dual check valve.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hydrants in compliance with ASSE requirements to prevent back-siphonage of contaminated water into the domestic water system.

3.02 CONNECTIONS

- A. Coordinate wall thickness with General Contractor for determination of valve stem length.

- B. Coordinate piping connection size and style with domestic cold water piping.
- C. Coordinate exterior wall opening size with General Contractor.

3.03 TESTING

- A. All fittings installed in the domestic water piping system shall be subjected to the same system integrity verification testing as the piping. See the domestic water piping specification section for processes and procedures.

3.04 DISINFECTION

- A. Components installed in the domestic water piping system shall be subjected to the same chlorination process as the piping. See the domestic water piping specification section for processes and procedures.
- B. Verify components and internal parts of all fittings subjected to system chlorination are compatible with the chemicals used in the chlorination process.

3.05 FIELD QUALITY CONTROL

- A. Upon completion of installation of Plumbing Specialties and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements.
- B. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 22 42 12

SECTION 22 42 21
WASHING MACHINE SUPPLY BOXES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 22 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies washing machine wall boxes and includes materials, testing and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. All plumbing systems shall comply with the Local Plumbing Code and all requirements of the local authority having jurisdiction.
- B. Plumbing systems shall comply with ANSI, ASPE, ASSE, ASTM, CSA, NSF, and AWWA requirements.
- C. Washing machine supply box connections shall comply with ANSI/ASSE 1035.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver washing machine wall boxes individually wrapped in factory-fabricated containers.
- B. Handle washing machine wall boxes carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures, replace and return damaged units to equipment manufacturer.

1.06 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 22 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 22 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Guy Gray Manufacturing
 - 2. IPS Corporation
 - 3. Oatey
 - 4. Symmons
 - 5. Watts Water Technologies

2.02 VALVES

- A. Furnish with slide on/off valve.

- B. Furnish with hot and cold water outlet connections with ½" standard hose threads.
- C. Furnish with hot and cold water inlet sweat connections.

2.03 WALL BOX

- A. Furnish with PVC wall box with wall flange.

2.04 DRAIN

- A. Furnish with 1-1/2" drain connection.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all units may be installed in accordance with pertinent codes and regulations, the original design and the referenced standards.
- B. Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 CONNECTIONS

- A. Drain and Vent:
 - 1. Coordinate piping connection size and style with domestic cold water piping.
 - 2. Coordinate wall opening size with General Contractor for recessed box applications.
- B. Water
 - 1. Coordinate piping connections on box for size and style with domestic cold water piping rough-ins.
- C. Installation: provide a recessed washing machine supply box at each washing machine.

3.03 TESTING

- A. All fittings installed in the domestic water piping system shall be subjected to the same system integrity verification testing as the piping. See the domestic water piping specification section for processes and procedures.
- B. All fittings and drains installed in the sanitary, storm and vent piping systems shall be subjected to the same system integrity verification testing as the piping. See the sanitary, storm and vent piping specification section for processes and procedures.

3.04 DISINFECTION

- A. Components installed in the domestic water piping system shall be subjected to the same chlorination process as the piping. See the domestic water piping specification section for processes and procedures.
- B. Verify components and internal parts of all fittings subjected to system chlorination are compatible with the chemicals used in the chlorination process.

3.05 FIELD QUALITY CONTROL

- A. Upon completion of installation of Plumbing Specialties and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements.
- B. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 22 42 21

SECTION 23 00 10
DOCUMENT INTERPRETATION AND GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this section. Contractors and Subcontractors shall also examine Architectural, Structural, Plumbing, Mechanical, Electrical and all other Drawings and Specifications pertinent to this project. The above mentioned Drawings and Specifications for all the Divisions are part of the Contract Documents.

1.02 SCOPE

- A. This section describes the requirements for demolition of HVAC equipment, materials, and systems and defines equipment and material salvage rights.
- B. This Section specifies requirements of Codes and Standards to which this project, including all manufactured equipment, on-site fabrication, and installation of all materials and equipment must conform.
- C. This Section specifies the basic requirements and procedures for shutting down existing, active Mechanical systems.
- D. This Section specifies the basic requirements and procedures for shutting down existing, active HVAC systems and includes requirements for temporarily services should a system need backfed during an unavoidable shut-down or need to remain operational at all times. Temporary services portion of this section supplements and expands on the requirements of Division 1.

1.03 INFERRED PHRASES

- A. Where the words "submit", "submitted", "approval", or "approved" or similar are used without an object of the verb, the phrase shall be assumed to read: "Submit to the Architect", "Submitted to the Architect", or "Approved by the Architect" as appropriate, unless otherwise noted.

1.04 PERMITS

- A. Unless noted otherwise, this Contractor shall secure and pay for all permits and certificates of inspection required for the work under this Division.
- B. Deliver all certificates and official records of approval, by governing agencies, to the Architect.

1.05 CODES

- A. Reference to the codes and standards listed shall constitute the minimum acceptable requirements. Nothing in the Specifications shall be construed to permit deviation from the requirements of the governing code. Where requirements of the Drawings and Specifications exceed those of the code listed, follow the Drawings and Specifications.
- B. The scope of work shall include the furnishing of systems, equipment and materials specified in this division and as called for on the Drawings and on the Schedules. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section. Work shall include supervision, operations, methods and labor for the fabrication, installation, start-up and tests for the complete installation.
- C. Install work in full accordance with rules and regulations of State, County and City authorities having jurisdiction over premises. This shall include safety requirements of the State of Ohio Division of Industrial Relations and OSHA.
- D. All wiring shall be in compliance with the current edition of the National Electric Code, Applicable State Code, applicable local (city) code, and OSHA. In cases of conflict between code and specifications, the more restrictive requirements shall govern.

- E. All equipment, materials and installation methods shall comply with the following, where applicable:
1. Building Officials and Code Administrators International (BOCA)
 2. Codes and Standards Association (CSA)
 3. International Building Code (IBC)
 4. International Mechanical Code (IMC)
 5. National Building Code (NBC)
 6. National Electric Code (NEC)
 7. National Fire Protection Association (NFPA)
 8. National Pressure Vessel Code
 9. Occupational Safety and Health Administration (OSHA)
 10. Ohio Building Code (OBC)
 11. Ohio Mechanical Code (OMC)

1.06 STANDARDS

- A. All equipment, materials and installation methods shall comply with the following, where applicable.
1. Air Conditioning and Refrigeration Institute (ARI)
 2. Air Conditioning, Heating, and Refrigeration Institute (AHRI)
 3. American National Standards Institute (ANSI)
 4. American Society for Testing and Materials (ASTM)
 5. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
 6. American Society of Mechanical Engineers (ASME)
 7. American Society of Sanitary Engineering (ASSE)
 8. American Water Works Association (AWWA)
 9. American Welding Society (AWS)
 10. Building Officials and Code Administrators International (BOCA)
 11. Cast Iron Soil Pipe Institute (CISPI)
 12. Codes and Standards Association (CSA)
 13. Fluid Sealing Association (FSA)
 14. International Association of Plumbing and Mechanical Officials (IAPMO)
 15. National Institute of Standards and Technology (NIST)
 16. National Pressure Vessel Code
 17. National Roofing Contractors' Association (NRCA)
 18. National Sanitation Foundation (NSF)
 19. National Science Foundation (NSF)
 20. Plastic Pipe Institute (PPI)
 21. Sheet Metal & Air Conditioning National Contractors' Association (SMACNA)

22. Underwriter's Laboratories of Canada (ULC)
23. Underwriters Laboratories, Inc. (UL)

1.07 DESIGN DRAWINGS

- A. The Contract Drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment, piping and ductwork unless dimensions are given. Equipment, piping, and ductwork are to be installed along the general plans shown on the Drawings, but keeping in mind actual building conditions.
- B. Because of the scale of the drawings, certain basic items may not be shown, but where such items are required by other Sections of these specifications or where they are required by the nature of the work, they shall be furnished and installed. Rough-in dimensions and locations shall be verified with the supplier of all equipment furnished by other trades or by the Owner prior to the time of roughing-in.
- C. All equipment, piping and material specified hereinafter as shown on the Drawings shall be furnished and installed by this Contractor, unless specifically indicated to the contrary.
- D. If this Contractor proposes to install equipment requiring space conditions other than those as specified and/or shown on the Contract Drawings, or to rearrange the equipment, he shall assume full responsibility and expense for the rearrangement of the space and shall obtain full written approval before proceeding with the work.
- E. This Contractor shall locate all equipment that must be serviced, operated or maintained in fully accessible positions. Minor deviations from the Contract Drawings may be made to allow for better accessibility, but changes of magnitude, or which involve extra cost, shall not be made without approval. Ample space shall be allowed for removal of all parts that may require replacement or service in the future.
- F. The Drawings and the Specifications are cooperative and supplementary. It is the intent of both said Drawings and Specifications to cover all mechanical requirements in their entirety as nearly as possible. This Contractor shall closely check the Drawings and Specifications for any obvious errors or omissions, and bring any such condition to the attention of the Design Professional prior to the receipt of bids, in order to permit clarification by means of an Addendum. If there are no questions prior to the bid proposal date, the Architect shall assume that the Drawings and Specifications are complete and correct and will expect the intent of said documents to be complied with, and the installation to be complete in all respects according to said intent.
- G. This Contractor shall have a complete set of drawings including Architectural, Structural, Plumbing, Fire Protection and Electrical drawings on the site at all times. Prior to installing any work, this Contractor shall check the drawings for exact dimensions and see that the work does not interfere with clearance required for beams, foundations, finished columns, conduits, pilasters, partitions, piping, ductwork, etc., as shown on the drawings and details. After work is installed, if interferences develop that have not been called to the attention of the Architect before the installation, this Contractor shall, at the Contractor's own expense, make such changes in work as directed by the Architect.
- H. Extra costs which might result from deviations from the Drawings, so as to avoid interferences, shall be considered a "Job Condition", and no additional compensation will be considered applicable. In the event that such interferences occur in the course of the Work, due to an error, omission, or oversight by the Contractor, no additional compensation shall be allowed. Interferences which may occur during the course of construction shall be brought to the immediate attention of the Architect, and his/her decision, confirmed in writing, shall be final.

1.08 EXAMINATION OF SITE

- A. Before submitting a bid, it is recommended that each Contractor visit the site and become familiar with conditions affecting this work. No additional payment will be made on claims that arise from lack of knowledge of existing conditions.

1.09 BASIS OF DESIGN EQUIPMENT

- A. Where more than one manufacturer is listed in the Specifications as being acceptable, it shall be understood that the "basis of design" manufacturer is the manufacturer included in the equipment schedule or with the model number listed. Subject to project requirements, all other listed manufacturers are considered as acceptable alternatives. If installation of an acceptable alternative alters the design, electrical or space requirements indicated on the Drawings, this Contractor shall bear the costs for the revised design and construction including costs of all trades involved.
- B. The acceptable alternative boiler manufacturers listed in these specifications have different dimensional footprints, clearance requirements, gas pressure requirements, ducted combustion air sizing requirements, flue/vent sizing requirements and electrical requirements that deviate from the "Basis of Design" boiler. If any of the acceptable alternative boiler manufacturers are chosen, this Contractor shall submit a 1/4" scale drawing of the boiler room to the Engineer for approval. The 1/4" scale drawing shall address all deviations from the basis of design manufacturer including combustion air and flue/vent sizes approved by the acceptable alternative boiler manufacturer. This Contractor shall include all costs for the alternative boiler manufacturer's deviations in the bid.

1.10 EQUIPMENT AND MATERIALS

- A. Prior to the signing of the Contract, the successful bidder may be required to submit a list of manufacturers of the major items of equipment he proposes to furnish and the names of any subcontractors he proposes to employ.
- B. When two or more items of same equipment type are required (pumps, fans, valves, etc.) they shall be of the same manufacturer.
- C. All equipment and materials shall be new.
- D. Provide material and labor which is neither drawn nor specified but which is obviously a component part of and necessary to complete work and which is customarily a part of work of similar character.

1.11 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of equipment, of types and sizes required whose products have been in satisfactory use in similar service for not less than 3 years.

1.12 COORDINATION AND SUPERVISION

- A. This Contractor shall examine the work of other trades and shall so coordinate and schedule work as not to cause delays or interference with work of others.
- B. Coordinate structural openings and the setting of sleeves with other trades, to accomplish the installation of equipment, ductwork and piping with minimal cutting through concrete or masonry.
- C. Coordinate the installation of all required supporting devices, inserts and hangers in structural components as they are constructed.
- D. Install HVAC equipment and components (valves, dampers, etc.) to facilitate servicing, maintenance and repair or replacement. Coordinate the final location of concealed equipment and components requiring access with the final location of access doors and panels. Allow adequate space for proper servicing, maintenance and repair. Make final connections to equipment with consideration for future disconnection and removal with minimal interference with other installations.
- E. Where installation is to occur in an area with no ceiling and mounting heights are not detailed or dimensioned on the Drawings, install equipment components and systems to provide maximum possible headroom.

- F. Install additional piping and ductwork offsets as required to obtain maximum headroom or to avoid conflicts with other work, without additional cost to the Owner.
- G. Before installing work, report any interferences between work of this Division and work of other Divisions to the Architect as soon as they are discovered. The Architect shall determine which work must be relocated, or make adjustments to maintain clearances and required headroom and to avoid conflict with other work. If any work is installed so that the Architectural design cannot be adhered to, this Contractor is liable for cost of making such changes as the Architect may require.
- H. Ceiling grid systems shall not be supported from equipment, ductwork or piping and vice versa. Where interferences occur, in order to support ductwork, piping, ceiling grid systems, etc., trapeze type hangers or supports shall be employed which shall be located so as not to interfere with access to HVAC equipment such as valves, dampers, etc.
- I. Provide adequate competent supervision at all times when work is being performed. Cooperate with all other trades to avoid interferences and delays.

1.13 PROTECTION OF WORK AND PROPERTY

- A. The Contractor shall be responsible for safeguarding work, property and facilities against damage, from the Contractor's own personnel as well as others, with which may come into contact in the performance of the work.
- B. Stored materials shall be protected against damage from weather. Pipe and duct openings shall be closed with caps or plugs during installation. All equipment shall be covered and protected from damage. Any materials or equipment damaged at any stage in the construction shall be replaced or repaired and shall be in a clean, unblemished condition at project turnover.
- C. Protect floors and walls against staining and abrasion from chips and cutting oil where pipe cutting and threading machines are used.
- D. Protect equipment and finished surfaces from welding, soldering, brazing and burning with baffles and blankets.
- E. Use drop cloths to protect finished surfaces from paint and insulation adhesive droppings.

1.14 DELIVERY, STORAGE AND HANDLING

- A. This Contractor shall pay all costs for the transportation of materials and equipment, included in this contract, to the job site.
- B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification.
- C. Each Contractor shall make provisions for the delivery and safe storage of materials and equipment in coordination with the work of others. Materials and equipment shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.
- D. Handle equipment and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged equipment or components; replace with new.
- E. Comply with manufacturer's ringing and installation instructions for unloading equipment and moving them to final location.
- F. The arrival and placing of large equipment items shall be scheduled early enough to permit entry and setting when there is no restriction or problem due to size and weight.

1.15 CLEAN-UP

- A. Refer to Division 1 for general requirements for final cleaning.
- B. Insofar as this Division is concerned, at all times keep premises and building in a neat and orderly condition, follow explicitly any instructions of the Architect in regard to storing of materials, protective measures, cleaning-up of debris, etc.

- C. Cap all open ends of ductwork during construction to eliminate the accumulation of construction dust inside ductwork. If dust accumulates during construction, ductwork shall be cleaned prior to project turnover.
- D. Upon completion of work remove all tools, equipment, surplus materials, etc. from the project site.
- E. Prior to project turn-over thoroughly clean all piping, and equipment, removing all dirt, grease, oil and dust. It is important that all dust accumulated inside control panels is removed. It is recommended that steps are taken to eliminate this dust buildup during construction.
- F. If air handling equipment is approved for use to provide temporary service, do not operate without proper filtration. Filters shall be installed at the inlets of all return air ductwork and the inside surface shall be cleaned prior to project turnover. Replace all filters used during construction with proper system filters prior to project turn-over.

1.16 DAMAGE AND EMERGENCY REPAIRS

- A. Assume responsibility for any damage caused by leaks in any piping system being installed or reworked under this Contract. Repair all damage without extra cost to Owner. Restore building, piping, insulation etc. to their original condition.
- B. The Owner reserves the right to make emergency repairs as required to keep equipment in operation, without voiding Contractor's guarantee or relieving him of responsibility during the warranty period.

1.17 WARRANTIES

- A. This Contractor shall warrant for a period of one year (from the date of final acceptance) that all work and equipment will remain free from all defects in workmanship and materials, and that it will comply with all the specific requirements of the Specifications and other Contract Documents governing the work.
- B. All work found to be defective will be replaced with new work meeting all the requirements of the Contract. This Contractor will bear all costs of supplying such new work, and installing and finishing same, and will assume all costs for replacing other work damaged by the removal and replacement of any of the work.
- C. Include copies of all warranties in the operation and maintenance manuals.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Examine areas and conditions where equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install equipment as indicated, and in accordance with manufacturer's installation instructions. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- C. Locate equipment, plumb and level, firmly anchored in locations indicated. Coordinate with other trades to assure correct recess size for recessed units. Hang ceiling units from building substrate, not from piping. Support units with rod-type hanger anchored to building substrate.
- D. All equipment shall be installed with adequate clearance provided for routine maintenance and servicing. Locate horizontal, above-ceiling units to maintain access with ceiling components below.

3.02 DEMOLITION WORK - SERVICES

- A. Active Services:

1. When encountered, support active mechanical services as necessary. If active services require relocation (other than those indicated on the drawings), obtain written instructions before proceeding. Do not disturb active services scheduled to remain.
- B. Inactive or Abandoned Services:
 1. When encountered, remove inactive and abandoned ductwork and piping full length. Removal shall include all hangers and supports. Notify servicing utility when encountered outside of structure.
- C. Interruption of Service:
 1. See "HVAC System Shut-downs" section for procedures and requirements.
- D. Tie-ins:
 1. In areas where new construction ties into existing facilities or in remodeled areas, dismantle the existing mechanical facilities as necessary. Relocate any existing services interfering with construction.

3.03 DEMOLITION WORK – GENERAL

- A. Remove equipment, materials, and systems as indicated on the drawings and per this section.
- B. Remove or relocate those mechanical services specifically indicated on the drawings and as required to complete demolition work.
- C. Remove all existing mechanical equipment, piping, ductwork, devices, controls and wiring in remodeled areas that interfere with new construction and are not necessary to maintain services that are to remain.
- D. Relocate, or extend as required, mechanical equipment, piping, ductwork, devices and wiring that interfere with new construction and is essential to maintain service to equipment and devices that are to remain.
- E. Remove or relocate those mechanical services specifically indicated on the drawings and as required to complete demolition work.
- F. All piping and ductwork and wiring to be removed shall be removed full length back to the active source.
- G. All holes or damage caused by the removal of existing work shall be properly patched. Holes shall be neatly patched with suitable materials to match existing surfaces.

3.04 SAFE DISPOSAL OF HAZARDOUS MATERIALS

- A. Mechanical Contractor shall safely dispose of all hazardous materials encountered in full compliance with all Federal, State, and EPA regulations.
- B. Mechanical Contractor shall identify installed facilities requiring removal or modification that are suspected to contain asbestos insulation. If suspicious insulation is encountered, the Mechanical Contractor will cease demolition or modifications and shall notify the Owner.
- C. The Mechanical Contractor shall not be responsible for removal of asbestos insulation.
- D. The Mechanical Contractor shall work with the owner's asbestos removal and abatement contractor to prioritize abatement work and develop a schedule for removal of hazardous materials so as not to affect the mechanical contractual timeframe.

3.05 SALVAGE

- A. Mechanical equipment, piping and devices that are to be removed shall be offered to the Owner for salvage. Equipment, piping and devices selected shall be stored on the site at areas designated by the Owner.
- B. All items not selected for salvage by the owner shall become the property of the Mechanical Contractor and shall be removed from the site by the Mechanical Contractor.

3.06 SYSTEM SHUT-DOWNS

A. General

1. The Contractor shall work with the Owner to schedule and plan required system shutdowns. The Contractor shall identify all necessary shutdowns and shall identify the approximate date shutdowns will be required at the outset of the project.
2. The Owner shall reserve the right to dictate final time and date of all shutdowns. The Contractor shall perform all shutdowns at the time and date as directed by the Owner, even if they are required to be performed on weekends or after normal business hours.
3. The Contractor shall work with the Owner's personnel to identify isolation valves in the existing systems requiring shut-down to properly isolate active portions of the system from the targeted inactive portion of the system. Should isolation valves not be present, or not be functional, the Owner shall be notified of the deficiency. In any case, the shut-down shall still be required and deficiencies of the existing system shall be planned around.

3.07 TEMPORARY SYSTEM BACK-FEED

A. When Required:

1. Amount of work necessitating a system be shutdown requires it to be taken out of service for a period of time greater than is allowed by the building owner.
2. A time and date is not available that fits within the project construction schedule and the owner's use of said system.

B. The Contractor shall arrange for temporary service of the system in question to provide the necessary utility for the building's use while the permanent system is deactivated to perform required work.

C. The cost of any equipment rental, temporary equipment power, hook-up of temporary equipment into the permanent system, etc., required to keep service of a utility to the building's occupants shall be considered a project requirement and shall not be considered additional services which would warrant a change order.

3.08 ADJUSTING AND CLEANING

- A. General: After construction is complete, including painting, clean all equipment exposed surfaces.
- B. Retouch any marred or scratched surfaces of factory-finish, using finish materials furnished by the manufacturer.

END OF SECTION 23 00 10

SECTION 23 01 10
PROJECT SUBMITTAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section contains:
 - 1. General requirements and procedures for Submittals and Shop Drawings.
 - 2. Requirements for Operation and Maintenance Manuals (O&M manuals) for all Division 23 work.
 - 3. Requirements for record drawings for documentation of installed conditions for all Division 23 work.
- B. For specific requirements, see individual specification sections.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Where applicable, the Contractor shall submit:
 - 1. Shop Drawings
 - 2. Operation and Maintenance Manuals
 - 3. Piping System Integrity Test Reports
 - 4. Ductwork Leakage Test Reports
 - 5. Start-up Reports
 - 6. Record Drawings
 - 7. Factory Tests
- B. A list of required submittals are specified in each individual specification section.

3.02 SUBMITTAL PROCEDURES

- A. Shop drawings
 - 1. Contractor Review
 - a. This Contractor shall review, stamp and sign with approval all submittals and deliver with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other Contractor.
 - b. Submission of shop drawings without review, signature, and approval shall be cause for rejection. Such submittals shall be returned without review.
 - c. If the submittal includes deviations from the requirements of the Contract Documents, the Contractor shall clearly note the deviations "in red" on the submittal.
 - 2. Electronic Submission
 - a. All submittals shall be in electronic format. Electronic submittals shall conform to this specification.
 - b. Electronic submittals shall conform to the following requirements:

- 1). Electronic submittals shall be in Portable Document Format (.pdf)
 - a). Electronic submittals shall include a transmittal.
 - b). All portions of the electronic submittal shall be bound in a single .pdf file.
 - c). File shall be named to match submittal name as it appears on the individual specification.
 - i. Example: "23 22 20 – Grilles and Diffusers".
 - d). Submittals shall specifically identify any deviations from the Contract Documents.
 - 2). Electronic submittals shall include a Contractor review stamp that indicates review and approval by the Contractor prior to submission.
 - 3). Electronic submittals shall be transmitted via an e-mail:
 - a). Provide only one submittal per e-mail
 - b). E-mail subject line shall clearly indicate:
 - i. Project name
 - ii. That the e-mail contains a submittal
 - iii. Contents of submittal
 - c). Failure to conform the requirements above may result in rejection.
 - d). At the Reviewer's discretion, the Reviewer has the option to return the submittals in whatever method is most convenient or appropriate for the Project.
3. Shop Drawing Cover Form
 - a). All submittals shall include a Cover form.
 - b). Follow the Architects requirements for the cover form.
 - c). Cover form shall contain, at a minimum, the following information:
 - 1). Submitting Contractors Contact information
 - 2). Shop Drawing Number and Name (As noted in Project Submittal Requirements)
 - 3). Issue (Original, Resubmittal 1, etc.)
 - 4). Name of equipment manufacturer
 - 5). Name of equipment supplier
 - d). If the submittal includes deviations from the requirements of the Contract Documents, the Contractor shall clearly indicate such deviations on the shop drawings cover form.
 4. Engineer's Review
 - a). Shop drawings shall be reviewed only for general compliance and not for dimensions or quantities. The Reviewer will make reasonable efforts to detect and correct errors, omissions and inaccuracies but shall not be responsible for failure to detect errors, omissions, or inaccuracies. Failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.

- b. The Engineer shall mark the shop drawings in one of the ways outlined below. See each description for interpretation of Engineers marks and Contractor responsibilities associated with each.
 - 1). APPROVED: The submittal complies with the requirements of the specifications.
 - 2). APPROVED AS NOTED: The submittal generally complies with the requirements of the specifications but some non-critical items which need to be corrected/coordinated are noted. The corrections shall be changed on the shop drawings submitted for inclusion in the Operations and Maintenance Manual. Re-submittal is not required unless noted otherwise.
 - 3). REVISE AND RESUBMIT: The submittal generally complies with the requirements of the specifications but some critical items which need to be corrected/coordinated are noted. The submittal must be revised and resubmitted with all comments addressed.
 - 4). REJECTED: The submittal does not comply with the requirements of the specifications. The submittal must be revised and resubmitted.
 - c. Approval of submittal items shall not eliminate the Engineers right to reject those items if defects are discovered prior to final acceptance of the completed work.
- B. Operations and Maintenance Manual
- 1. Submit one (1) copy of the Division 23 manual to the Architect/Engineer for review.
 - 2. After review, address Architect/Engineer's comments and provide the Owner with three (3) hardbound copies of the final approved operating and maintenance manuals for Division 23. Obtain receipt. Note – Operation and Maintenance manuals are required before Owner training takes place.
- C. Record Drawings
- 1. Submit a complete set of red-lined drawings indicating "as-installed" locations of piping, ductwork, and equipment.

3.03 SHOP DRAWING CONTENT

- A. Indicate specific options or accessories on shop drawings by pointing to, checking off, or underlining. Do not use highlighter.
- B. Do not reproduce Contract Documents or copy standard information as the basis of shop drawings. Standard information prepared without specific reference to the Project is not considered shop drawings and will be cause for rejection.
- C. Shop Drawings shall contain the following information, where applicable.
 - 1. General:
 - a. Model Number
 - b. Dimensions
 - c. Weight
 - d. Clearance requirements
 - e. Special rigging requirements
 - f. Material
 - g. Color and finish
 - h. Installation recommendations

- i. Ratings
- j. All included options and accessories
- 2. Performance:
 - a. Performance data as scheduled and/or specified (at a minimum)
 - b. Code/standard compliance information
 - c. Pressure drop curve or chart
- 3. Connections:
 - a. All pipe and duct connections, including:
 - 1). Size(s)
 - 2). Location(s)
 - 3). Connection service (Supply, return, exhaust, etc.)
 - 4). Connection method
 - b. Electrical connections:
 - 1). Location(s)
 - 2). Termination lug size(s)
 - 3). Plug NEMA configuration
- 4. Electrical:
 - a. Characteristics, including:
 - 1). Voltage/Phase
 - 2). Full load and locked rotor amps
 - 3). Required overcurrent protection and short circuit interrupting capacity
 - 4). Horsepower of motor(s)
 - b. Power wiring diagram
 - c. Accessories furnished, including starter(s), disconnect(s), on/off switches, etc.
 - 1). Clearly indicate if accessories are factory or field mounted/wired.
- 5. Controls:
 - a. Wiring terminations for required interlock and control wiring
 - b. Wiring diagram, with factory installed and field installed portions clearly differentiated.
 - c. Accessories furnished, including thermostat(s), sensor(s), etc.
 - 1). Clearly indicate if accessories are factory or field mounted/wired.
 - d. Sequences of operation
 - e. Integration
 - 1). Protocol(s), including baud rate.
 - 2). Available points, with read/write capabilities clearly noted.
 - 3). Registers required for integration.
- 6. Refer to individual specifications sections for special required information.

3.04 OPERATOR AND MAINTENACE MANUAL CONTENT AND FORMAT

- A. Binder:
 - 1. Include all materials in a three (3) ring binder or binders, if volume of content dictates multiple books.
 - 2. Provide a type-written cover for the binder indicating project title, contractor firm name and address, date of substantial completion (project finish date), and owner company name.
- B. Index:
 - 1. Include a numbered index indicating ALL documents included in the manual.
- C. References:
 - 1. Include a page or pages indicating contractor firm name, address, and contact phone number.
 - 2. Indicate the contractor's job foreman, including contact phone number and email address.
 - 3. Indicate all subcontractors utilized, including contact phone numbers and email addresses for each.
 - 4. Name of service agency and installer. Include 24 hour per day emergency phone numbers.
 - 5. Include design Architect reference, including contact phone numbers.
 - 6. Include design Engineer reference.
- D. Contents:
 - 1. Provide a separate tabbed section for each specified item type including the following, if applicable:
 - a. Identification, name, mark, or number as indicated on the design drawings.
 - b. Final accepted shop drawing, including Engineer's cover form indicating "Accepted" without exception.
 - c. Manufacturer's maintenance and service manuals including instructions for troubleshooting, disassembly, repair, reassembly, adjusting, aligning, servicing and lubrication.
 - d. Spare/replacement parts list.
 - e. Belt sizes, type and lengths (where applicable).
 - f. Step by step procedures for startup and shutdown of each system and piece of equipment.
 - g. Copy of equipment start-up report and/or capacity test (if required as part of equipment specification). See Equipment and System Start-up specification section for requirements.
 - h. Equipment manufacturer's warranty.
 - 2. Automatic controls including device schedules, diagrams and written sequence of operations.
 - 3. Final accepted balance reports as required by this specification.
 - 4. Copy of all system integrity verification report, where required. See Piping Systems Flushing and Testing specification section for requirements.
 - 5. Copy of all piping system flushing, cleaning, and certification reports as required by this Specification.

6. Copy of testing, adjusting, and balancing report as required by this division specification.
 7. Copy of Ductwork leakage testing report as required by this division specification.
- E. Warranties
1. Contractor warranty including date of final acceptance (this indicates the start of the warranty period).
 2. Date of final acceptance shall be issued by the Architect.
- F. Electronic Requirements
1. Provide Operations and Maintenance Manuals to Owner and Engineer in .pdf format.

3.05 RECORD DRAWINGS CONTENT

- A. Field Documentation
1. This Contractor shall record all changes from original design drawings made during installation. These changes shall be recorded in red ink on a dedicated copy of the final approved construction or coordination drawings. Changes shall be accurately dimensioned and/or drawn to scale.
 2. This Contractor shall keep an updated set of prints, including changes, on the job site at all times and shall submit one (1) set of updated and legible "as-built" prints to the Architect when the work is complete.
 3. Prepare record documents in accordance with the requirements in Division 1.
 4. In addition to the requirements specified in Division 1, indicate the following installed conditions.
 - a. Ductwork mains and branches and locations of balancing dampers, motor operated dampers, control devices, coils, etc.
 - b. Piping mains and branches and locations of isolation valves, balance valves, control valves, regulating valves, strainers, expansion devices or loops, air vents, etc.
 - c. Locations of all equipment.
 - d. Locations of all equipment controllers, control panels, sensors, control devices, etc.
 - e. Locations, inverts, and sizes of all underground piping and power.
 5. Record documents shall include all deviations from the Contract Documents including any substitutions.
 6. If the project requires the preparation of coordination drawings, the coordination drawings shall be submitted as record documents.

END OF SECTION 23 01 10

**SECTION 23 01 30
COORDINATION DRAWINGS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. Coordination drawings are limited to the mechanical room area only.
- B. This section describes the requirements for coordination of all trades prior to installation of building systems and the requirements of deliverable coordination drawing sets.
- C. Provide pre-construction coordination of all trades and coordination drawings as described in this section.

1.03 RESPONSIBILITIES

- A. The **Division 23 Contractor** shall be the lead coordination contractor. The lead coordination contractor shall obtain information from all other trades (plumbing, fire protection, electrical, structural, general, etc.) and assemble this information into a coordination set of drawings. The lead coordination contractor shall manage the coordination drawing execution process.
- B. All trades shall review coordination drawings and assist the lead coordination contractor with clash detection and conflict mitigation pertaining to their specific system and equipment.

1.04 SUBMITTALS

- A. Provide complete sets of coordination drawings for approval.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 FORMAT

- A. Furnish all drawings in **Autodesk Revit 2014 or later**, and as agreed upon by all contractors prior to the commencement of coordination efforts.
- B. Scale: ¼"=1'-0" minimum
- C. Final drawings shall be submitted as hard copy color print shop drawings for review and approval by the Architect and Engineer.
- D. Trades and/or systems shall be assigned a separate color for easy distinction. Colors shall be assigned to all supporting divisions by the lead coordination contractor.
- E. All equipment shall be tagged to match the corresponding tag on the construction documents.
- F. Photocopied, reproduced or traced drawings of the original Contract Documents shall not be used as coordination drawings.
- G. Single line drawings of the ductwork layout will not be allowed to be used as part of Coordination Drawings.
- H. Electronic files of the original Contract Drawings will not be allowed to be used as coordination drawings.

3.02 CONTENT

- A. Prepare coordination drawings in accordance with Division 1 Section "Project Coordination" and for all areas of the building as follows:
 - 1. Above all ceilings and in all interstitial spaces.
 - 2. For all Mechanical Equipment Rooms and areas where mechanical and plumbing equipment is installed.

3. For all areas where careful coordination is needed for installation of products for and materials fabricated by separate entities.

B. Required Systems

1. Equipment
 - a. Air handling units, terminal units, boilers, chillers, cooling towers, heat exchangers, air separators, tanks, pumps, fans, terminal heating equipment, domestic water heating equipment, reduced pressure backflow preventers, plumbing fixtures, etc.
 - b. All equipment shall be shown with access areas indicated manufacturer's recommended clearance requirements.
2. Ductwork
 - a. Include supply air, return air, exhaust air, relief air, outside air, specialty duct systems, flue and vent duct systems, etc.
3. Piping
 - a. Include HVAC piping
 - b. Include all division 21 and division 22 piping.
4. Electrical Wiring
 - a. Include power, fire alarm, paging, tele-data, low voltage, etc.
5. Electrical Equipment
 - a. Include size and location of disconnects, transformers, switchgear, motor control centers, pull boxes, buss ducts, cable trays, lighting fixtures, and starters.
6. Controls
 - a. Include sensor locations, panel locations, power, network wiring, low voltage wiring, etc.
7. Building architecture and structure
 - a. Walls and associated wall heights.
 - b. Structural beams, column locations and elevations.
 - c. Slab layout, dimensions with elevations.
 - d. Ceiling types and elevations.
8. Special building systems
 - a. Include pneumatic transfer tube systems, etc.
9. Miscellaneous
 - a. Access panel locations (coordinate type and size with general trades).
 - b. Equipment housekeeping pads.
 - c. Floor drains and floor cleanouts.
 - d. Framing and suspension details for equipment suspended from above.
10. Existing Conditions
 - a. Any existing pipe, ductwork or equipment which will impact routing and layout of new work (such as existing storm drains and sanitary/vent piping), shall be field measured by this Contractor and shown on coordination drawings.

- C. Quantities, dimensions and locations of equipment connections for piping, ductwork and electrical systems shall be verified with equipment suppliers and included in the preparation of coordination drawings.
- D. Show relation of all items of heating, ventilating and air conditioning equipment, ductwork and piping, plumbing equipment and piping and fire protection equipment and piping. Indicate all electrical devices that affect location of heating, ventilating, air conditioning and plumbing equipment, piping, ductwork and air inlets or outlets. Field measure and show existing items affecting new installation in remodeled areas.

3.03 PHASING

- A. This project is broken into multiple phases of work. **Spaces surrounding phased work areas are to remain occupied during construction.** Many of these phases require demolition of and alterations to sprinklers, plumbing, HVAC, and medical gas systems within the phased work area that affect surrounding areas outside of the phased work area. Temporary piping and ductwork to areas outside of each phased work area shall be shown on coordination drawings to allow those areas to remain occupied during construction.

3.04 PROCEDURE

- A. Review with the construction documents to gain advanced familiarity with the design.
- B. Collect Autocad or Revit files from engineer.
- C. Schedule
 - 1. Prioritize coordination process with the project schedule to ensure milestones are met and construction activities are not delayed.
- D. Modify Drawings
 - 1. Draw in actual sizes of equipment per the approved shop drawings. In areas of the design documents where piping, ductwork, conduit, equipment, etc. are shown diagrammatically, draw in actual to-scale illustrations of same.
 - 2. Identify areas where valves, controls, or other miscellaneous equipment is concealed within walls and add appropriately sized access doors suitable for installation in the associated wall, shaft, or ceiling assembly.
 - 3. Add access clearance boundaries to all equipment specified under this specification division.
 - 4. Review installation details (either from manufacturer's published installation instructions or design installation details) and add miscellaneous items such as concrete housekeeping pads, installation supports, etc. to coordination drawing content covered under this specification division.
- E. Consolidate
 - 1. Submit coordination drawings to the Lead Coordination Contractor. The Lead Coordination Contractor shall collect coordination drawings from other trades and compile all content into a single set of coordination drawings.
- F. Clash Detection
 - 1. The Lead Coordination Contractor shall overlay all trade content and identify areas of conflict, and then prepare a list of these areas and notify the appropriate trades to meet and review conflicts.
- G. Conflict Mitigation
 - 1. Review areas of conflict and develop proposed solutions.
 - 2. Arrange a meeting with the Lead Coordination Contractor and all other trades to review proposed solutions.

3. Select a proposed solution. Each trade affected must indicate acceptance of the illustrated conditions by attaching his endorsement to each drawing.
 4. Revise coordination drawings to incorporate proposed solution.
- H. Preliminary submission
1. The Lead Coordination Contractor shall bubble / cloud all changes from the original design documents.
 2. Any un-resolved coordination items should be indicated via coded notes on the coordination drawings. Engineer/Architect will not review un-resolved coordination items before a thorough review and coordination effort is completed by the contractor.
 - a. If there no interferences indicated or bubbles on the coordination drawings, the Engineer and Architect shall assume that the drawings and specifications are complete and correct and will expect the intent of said documents to be complied with, and the installation to be complete in all respects according to said intent.
 3. The Lead Coordination Contractor shall submit coordination drawings to the appropriate party in compliance with the project communication chain (i.e. Construction Manager, Architect, Engineer).
- I. Engineering's Review
1. Engineer will review and comment on proposed Conflict Mitigation solutions.
- J. Re-submissions
1. Incorporate all Architect's/Engineer's comments into coordination drawings.
 2. Each trade affected must indicate acceptance of the Engineer's / Architect's revisions by attaching his endorsement to each drawing.
 3. The Lead Coordination Contractor may request a coordination meeting between all trades and associated Engineers and Architect as required to complete Conflict Mitigation.
 4. Resubmit coordination drawings to Engineer / Architect for review.
 5. Perform additional iterations of this procedure as required to mitigate all conflicts and create final-approved coordination drawings.
- K. Final Submission
1. Final sign-off coordination drawings (approved by Architect / Engineer) shall be on the job-site at all times.
 - a. Record any adjustments from original signed-off coordination drawings that were made during the final installation of the work. See Record Drawings specifications section for further procedures and details.
 2. Proceed with installation only after review and approval of coordination drawings by the Architect and Engineer and approval from other trades affected.

END OF SECTION 23 01 30

**SECTION 23 02 10
OWNER OPERATING AND MAINTENANCE TRAINING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the general requirements for the purpose of operations and maintenance training of the Owner's facility personnel on the systems and equipment installed or modified under this project's contract.
- B. Provide training to the Owner's designated personnel for all equipment and systems listed herein. Individual specification sections indicate the number of training hours required.

1.03 SUBMITTALS

- A. Submit to the Architect a schedule of all training sessions, topics to be covered, times, and attending personnel at least fourteen (14) days prior to the first session.
- B. Submit to the Architect a sign-in sheet from each training session, with all attending personnel, including contractor's training personnel and manufacturer's representatives, date, number of hours, and time of the training session.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Prior to acceptance of the work and after all equipment is in operation, provide to the Owner instructions for the purpose of training the Owner's personnel in all phases of operation and maintenance of equipment and systems provided under this Division.
- B. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instruction, and shall arrange to have the manufacturer's representatives present to assist with the demonstrations where specified.
- C. Operation and maintenance manuals shall be provided to the Owner at least fourteen (14) days prior to the first training session.

3.02 TRAINING REQUIREMENTS

- A. The demonstrations shall consist of not less than the following:
 - 1. Point out the actual location of each component of a system and demonstrate its function and its relationship to other components within the system.
 - 2. Demonstrate each system by actual "start-stop" operation showing how to work controls, how to reset protective devices, how to replace components requiring regular maintenance, and what to do in an emergency.
 - 3. Demonstrate communication, signal, alarm and detection systems by actual operation of the systems and show how to reset signal, alarm and detection devices.
 - 4. Demonstrate coil pull access is unimpeded.
 - 5. Demonstrate tube-bundle pull for boilers.

3.03 SCHEDULE AND AGENDA

- A. Submit a schedule of training events, including proposed date, starting time and ending time of each training session to the Architect/Engineer, Commissioning Agent and Owner prior to the completion of construction for review and approval.

- B. Equipment and systems requiring a training session are indicated in each equipment and/or system's dedicated specification section.
- C. Indicate required attendees and proposed trainers required for each training session with the event schedule.
- D. Indicate proposed training session topic, associated equipment, and rough training session agenda.

3.04 COMMISSIONING AGENT

- A. If the project has a Commissioning Agent, the Commissioning Agent shall be present for all training sessions, when commissioning is specified for the project.

3.05 SIGN-OFF

- A. If the project has a Commissioning Agent, the Commissioning Agent shall verify completion of training sessions. See attached form.
- B. Owner shall verify completion of training sessions. See attached form.

END OF SECTION 23 02 10

SECTION 23 03 10
HYDRONIC PIPING SYSTEMS FLUSHING AND TESTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping systems' testing and cleaning requirements common to more than one section of Division 23. Portions of this Section may not be required in this project.
- B. Provide all materials, equipment, labor and supervision necessary to perform all piping testing and cleaning work described in this Section.
- C. Cleaning and testing requirements for hydronic piping, steam piping, and refrigerant piping are specified in those specification sections.

1.03 CODES AND STANDARDS

- A. All mechanical piping systems shall be tested in accordance with the Local Mechanical Code.
- B. All pressure piping systems shall be tested in accordance with the OAC 4101:8 "Pressure Piping System Rules".

1.04 SUBMITTALS

- A. Operation and Maintenance Manuals:
 - 1. Include a copy of all pressure test reports.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION

3.01 INSPECTIONS

- A. Obtain all piping inspections required by the authorities having jurisdiction over premises. Furnish all certificates of such inspections and include in the Operating and Maintenance Manuals. Pay all fees necessary for the inspections.
- B. No part of system shall be covered before inspection is made and approved. If covered before test, Contractor shall pay for cost of uncovering so test can be made and accepted.

3.02 TESTING - GENERAL

- A. See each specific piping system specification section of Division 23 for applicable test and specific testing requirements.
- B. Perform piping system pressure tests to all new piping systems prior to final connections to equipment and prior to connection to existing building piping. If equipment is connected, it shall be isolated from the system during the test.
- C. Perform all tests before piping is concealed, insulated or heat traced.
- D. Contractor is responsible for completely draining the systems after hydrostatic tests are performed. Any damage from freezing prior to acceptance of the completed installation shall be repaired at no additional cost to the Owner.
- E. Correct minor leaks in welded joints by chipping out weld and re-welding. Correct leaks in screwed joints by replacing thread or fitting or both. Caulking of threaded joints is not permitted. Repair leaks in copper pipe by sweating out joints, thoroughly cleaning both pipe and fitting, and re-soldering.
- F. Contractor is responsible for providing all equipment, power and labor necessary for performing all required inspections and tests.

G. Pressure tests shall be witnessed by Owner's representative.

3.03 HYDRONIC SYSTEMS

- A. Each heating water, chilled water, tower water, heat pump closed loop system shall be tested as a whole system or in sections, such that no part of the complete system is left untested. Testing shall comply with the following:

Table 23 03 10.1

Medium	Pressure	Duration	Requirements
Water	1.5 times maximum system design pressure, 100 psig minimum	6 hours	No appreciable pressure loss

3.04 STEAM AND CONDENSATE SYSTEMS

- A. Preparing for Testing: Prepare steam and condensate piping accordance with ASME B31.9 and as follows:
1. Leave joints including welds uninsulated and exposed for examination during the test.
 2. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
 3. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve.
 4. Temporarily install a relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.
- B. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for personnel and compatible with the piping system components.
- C. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
- D. Subject piping system to a hydrostatic test pressure as shown in the following table:

Table 23 03 10.2

System Pressure	Test Pressure	Duration
75 psi and below	125 psi	6 hours
Greater than 75 psi	200 psi	6 hours

- E. After the hydrostatic test pressure has been applied for the required time period, examine the system for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.
- F. After testing is complete, flush the system with clean water. Remove the relief valve that was installed for testing. Remove, clean and reinstall strainer screens.

END OF SECTION 23 03 10

**SECTION 23 03 20
EQUIPMENT AND SYSTEM START-UP**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes equipment and systems general start-up requirements, procedures, documentation, and submission requirements. See individual specifications sections for additional requirements.
- B. Furnish all materials, labor, and supervision to properly start-up equipment and systems provided under this Division and as required by this section.

1.03 SUBMITTALS

- A. Operations and Maintenance Manuals:
 - 1. Include a copy of all Equipment and System Start-up Forms in the Operations and Maintenance Manuals.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SCHEDULE

- A. Coordinate schedule for start-up, testing and adjustments of various equipment and systems with the Architect, other contractors and Owner.
- B. Contact all parties, including the Architect, required to witness equipment start-up as indicated in each equipment and system specification section of this division. Contractor shall give at least two (2) week's notice to all parties of scheduled start-up date and time.

3.02 EXAMINATION

- A. Prior to start-up verify the following:
 - 1. That each piece of equipment or system is supported properly.
 - 2. That each piece of equipment or system has been checked for proper lubrication, wiring, drive rotation, belt tension, belt alignment, shaft alignment, control sequence or other conditions which may cause damage.
 - 3. Check vibration isolation devices to verify spring locks have been removed and vibration isolators are unconstrained.
 - 4. That all tests, meter readings and specified electrical characteristics agree with those required by the equipment or system.
 - 5. Check equipment containing a separately coupled motor for proper motor and shaft alignment.

3.03 LUBRICATION AND PACKING

- A. Properly lubricate all rotating or reciprocating equipment before it is started with correct grade, type and quantity of lubricant as recommended by manufacturer.
- B. Check each shaft containing a packing gland condition by backing packing gland off and examining for proper grade, amount and type of packing as recommended by manufacturer.
- C. Maintain all lubrication, gaskets and packing during construction. Assure that at the time of final project acceptance all are in first class condition.

3.04 CORRECTION OF DEFICIENCIES

- A. Any conditions found to be unsatisfactory to the standards outlined by the manufacturer or these specifications during the cursory pre-start-up examination process shall be corrected prior to actual start-up of equipment and systems.

3.05 EQUIPMENT AND SYSTEM START-UP

- A. Follow manufacturer's recommendations and requirements for start-up of all equipment.
- B. Document date of equipment start-up for commencement of manufacturer's warranty.
- C. If required by the specific equipment or system specification section, provide the following:
 - 1. Factory authorized personnel present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
 - 2. Submit a written report that equipment or system has been properly installed and is functioning correctly.
- D. During the start up testing or adjustment period, maintain on the project, a contractor representative thoroughly familiar with all phases of the project for as long a period as required to start up all equipment and systems and demonstrate that they are functioning properly.
- E. Contractor is responsible for furnishing any and all instruments required to start up and test equipment or systems which include thermometers, electric meters, pressure gauges, etc.

3.06 ADJUSTMENTS

- A. Contactor shall make adjustments, if required, to equipment and systems after starting them up and observing them operate for a sustained period of time. Corrections shall be made if systems are excessively noisy or vibrating excessively.
- B. The Engineer or his representative, may make spot checks to determine the accuracy and completeness of final adjustments. Should spot checks indicate more than a reasonable deviation from design requirements, the Contractor shall repeat tests and adjustments to the satisfaction of the Engineer.

END OF SECTION 23 03 20

SECTION 23 03 30
TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies of testing, adjusting and balancing requirements including general procedural methods. Provide all equipment, labor and supervision necessary to perform all work described in this Section.
- B. The extent of testing, adjusting and balancing work is indicated on the drawings and by requirements of this Section. Requirements include: measurement and establishment of the air and fluid quantities of the air and hydronic systems as required to meet design specifications, adjustment of the flow or equipment speed by adjusting valves or dampers or changing belts and sheaves to obtain desired results and recording and reporting the results.
- C. The work of this section shall be the responsibility of the Testing and Balancing Contractor working as an independent Sub-Contractor to the Mechanical Contractor. The Mechanical and Controls Contractors shall provide labor and materials to coordinate with this work.
 - 1. The Mechanical Contractor shall make all changes in sheaves, belts and dampers as required by the Testing and Balancing Contractor. **The Mechanical Contractor shall be responsible to furnish and install replacement sheaves and belts. All variable pitch sheaves shall be replaced with constant pitch sheaves** at the time of final balancing by the Mechanical Contractor.
 - 2. The Mechanical Contractor shall add all balancing dampers as required by the Testing and Balancing Contractor.
 - 3. The Controls Contractor shall verify that all control components are functional, calibrated properly and set for design operating conditions and shall assist the Testing and Balancing Contractor as required for a complete testing, adjusting and balancing of the HVAC System.
 - 4. The Balancing Contractor shall work with the Controls Contractor to establish duct static pressures and hydronic differential pressures for hydronic and air moving equipment. These setpoints shall be noted in the balance report and each equipment sensor location shall also be noted in the balance report.
 - 5. For variable speed fans, fan and motor pulleys shall be replaced with fixed pitch pulleys so that motor is fully loaded at 100% speed (60 hertz). Balance to design air flow by adjusting maximum variable speed drive output below 100%. Note speed (hertz) at which unit attains design flow in balance report.
 - 6. The Balancing Contractor shall work with the variable frequency drive (VFD) manufacturer's start-up representative to determine all resonant frequencies found on VFD-driven fans and pumps. These resonant frequencies shall be noted in the balance reports and shall be programmed by the VFD technician for critical avoidance frequencies.
 - 7. The following devices and equipment shall be measured and documented in the Balance Report:
 - a. Air Handling Units – Including Return Fans
 - b. Exhaust Fans
 - c. Air diffusers and grilles

- d. Hydronic Coils
- e. Finned Tube circuits
- f. Hydronic Terminal Units
- g. Heating Water Pumps
- h. Chilled Water Pumps
- i. Domestic hot water recirculating pumps and recirculating hot water balance valves gpm

1.03 QUALITY ASSURANCE

- A. Companies performing work of this Section shall have at least three years experience and specialize in the testing of systems similar to those included for this project.
- B. Employ the services of an independent testing, adjusting and balancing agency meeting the qualifications specified below to be the single source of responsibility to test the air distribution systems identified above. Independent means the mechanical contractor shall have no vested interest in the testing and balance agency.
- C. Agency shall be an independent testing agency certified by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) in those testing disciplines required for this project.
- D. Perform total system testing in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.04 SUBMITTALS

- A. Prior to commencement of the work described in this Section, the Testing, Adjusting, and Balancing (TAB) Contractor shall submit verification of his AABC or NEBB certification to the Design Professional for acceptance.
- B. Certified Reports:
 - 1. Prior to commencement of the work described in this Section, the Testing, Adjusting, and Balancing (TAB) Contractor shall submit verification of his AABC or NEBB certification to the Design Professional for acceptance.
 - 2. Submit one electronic copy of the testing report bearing the seal and signature of the Test Engineer and the name of the field technician who performed the work (if other than the Engineer).
 - 3. The reports shall be certified proof that the air and water system pressure testing and balancing, including all electrical performance of each piece of HVAC equipment, has been tested in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing procedures; and, are an accurate record of all final quantities measured.
 - 4. Follow the procedures and format herein specified.
- C. Report Contents: Provide the following minimum information, forms and data:
 - 1. Provide General Information and Summary information inside the cover sheet to identify testing, adjusting and balancing agency, Contractor, Owner, Engineer and Project. Include addresses and contact names and telephone numbers. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
 - 2. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABS or NEBB for each respective item and system.

- D. Seasonal Testing: If initial TAB procedures were not performed during near peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near peak summer or winter conditions.
- E. 11 Month Warranty Walk: TAB to perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to report unusual conditions with recommendation of adjustments. TAB Contractor shall allow two (2) days for this work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROCEDURAL REQUIREMENTS

3.02 GENERAL

- A. Do not begin adjustments until systems have been completed and are in full working order. All heating, ventilating, exhaust and air conditioning systems and equipment shall be fully operational and shall operate continuously during each working day of testing and balancing.
- B. The balancing agency shall adjust and balance all air and water system components to no more than the following tolerances:
 - 1. Supply, Return, and Exhaust Fans: Plus 10 percent to minus 5 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Heating Water Flow Rate: Plus 10 percent to minus 5.
 - 4. Cooling Water Flow Rate: Plus or minus 5 percent.
- C. The balancing agency shall advise the installing contractor(s) of any additional work required to obtain design performance during the course of the balancing work. Such additional work shall be performed prior to the completion of balancing and submission of the balancing report.
- D. During the testing period, this Contractor shall maintain on the job a competent individual thoroughly familiar with all phases of the air and water distribution systems, including controls, for as long a period as may be required to thoroughly adjust all of the systems and to demonstrate to the Architect that they are functioning properly.
- E. Perform testing and balancing procedures on each system identified in accordance with the detailed procedures outlined in the referenced standards.
- F. Cut insulation on ductwork and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. Patch insulation on piping, ductwork and housings using materials identical to those removed. Holes in ducts and casings used for static pressure and velocity readings shall be provided with removable plugs. Probe locations shall be identified on the duct.
- G. The sheet metal contractor shall seal all ducts prior to testing and repair all leaks found during testing.
- H. Seal insulation to re-establish integrity of the vapor barrier.
- I. Mark equipment settings, including damper hand quadrants, valve indicators, and similar controls and devices to show final settings. Mark with paint or other suitable permanent identification materials.
- J. Retest, adjust and balance systems subsequent to significant system modifications and resubmit test results.
- K. Check mechanical systems for excessive noise and vibration and include observations in report.
- L. Pumps with variable speed drives shall be balanced with balance valves at the pumps 100% open (not including balancing valves at coils).

3.03 PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING

- A. Before operating any systems, perform these steps:

1. Open pump balance valves to full open position.
2. Open coil balance valves to full open position.
3. Close coil bypass valves.

3.04 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

- A. Before operating any systems perform these steps:
 1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
 2. Obtain copies of approved shop drawings of all reheat coils, air inlets and outlets (supply, return and exhaust) and temperature control diagrams.
 3. Compare design to installed equipment and field installations.
 4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
 5. Check filters for cleanliness.
 6. Check dampers for correct and locked position and temperature control and safeties for completeness of installation before starting fans.
 7. Prepare report test sheets for reheat coils and diffusers, registers and grilles. Obtain manufacturer's diffusers, registers and grilles factors and recommended procedures for testing.
 8. Determine best locations in main and branch ductwork for most accurate duct traverses.
 9. Place outlet dampers in the full open position.

3.05 REQUIREMENTS FOR SPECIFIC SYSTEM COMPONENTS

- A. Diffusers, Grilles, and Registers
 1. Identify each diffuser, grille and register as to location and area. Tabulate design velocity and CFM, and test velocity and CFM after adjustment and list size, and type of diffusers, grilles and registers. Adjust supply diffusers, grilles and registers for proper air distribution pattern to eliminate drafts.
- B. Air Terminal Units (Boxes)
 1. Measure air flows under varying conditions. Set volume controls on all terminal boxes as necessary to meet design requirements. Do not assume factory preset settings are correct.
- C. Air Handling Equipment
 1. List the data of each fan, motor and drive (belts and sheaves) and obtain by measurement the fan speed, motor voltage, operating amps, fan CFM and static pressure as determined from the manufacturer's fan curves. Also measure the fan CFM by means of a velocity traverse which shall be taken a minimum of three fan diameters from the fan or unit inlet or outlet. Before running any tests, the Contractor shall have installed all the components of the system and insure the cleanliness of the filters. Artificially load air filters by partially blanking of filter bank to produce an air pressure drop midway between cataloged clean and dirty rating. Document pressure drop of each filter bank at which unit was balanced. For belt driven fans, document both sheave sizes and belt sizes. Document measured minimum outdoor air CFM.
 2. Provide a unit pressure profile for each air handling unit. Profile shall show each component and the pressure within each unit section (between components) with the unit running at full design flow.

D. Hydronic Equipment

1. All water using equipment shall be balanced to obtain the required water pressure drop and flow. This Contractor shall list the design flow rate and pressure drop and the observed flow and pressure drop for each piece of equipment. Bypass legs on three-way valves shall be balanced to equal pressure drop through the coil at full flow.

E. Pumps

1. List each pump's design data and obtain by measurement each pump motors' voltage, amperage, and pump heads with no water flow and with full water flow. Include copies of manufacturer's pump curve indicating operating point.

F. Miscellaneous Balance Valves

1. Document the design required water flow rate. Measure and record the water flow rate. Tabulate the measured water flow rate as a percentage of the required design flow rate.

END OF SECTION 23 03 30

**SECTION 23 03 40
DUCTWORK LEAKAGE TESTING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies Ductwork leakage testing requirements including general procedural methods. Provide all equipment, labor and supervision necessary to perform all work described in this Section.
- B. The extent of testing work is indicated on the drawings and by requirements of this Section. Requirements include: measurement and documentation of duct leakage.
- C. The work of this section shall be the responsibility of the Testing and Balancing Contractor working as an independent Sub-Contractor to the Mechanical Contractor. The Mechanical and Sheetmetal Contractors shall provide labor and materials to coordinate with this work.

1.03 QUALITY ASSURANCE

- A. Companies performing work of this Section shall have at least three years experience and specialize in the testing of systems similar to those included for this project.
- B. Employ the services of an independent testing, adjusting and balancing (TAB) agency meeting the qualifications specified below to be the single source of responsibility to test the air distribution systems identified above. Independent means the mechanical contractor shall have no vested interest in the testing and balance agency.
- C. Agency shall be an independent testing agency certified by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) in those testing disciplines required for this project.
- D. Perform total system testing in accordance with SMACNA, AABC National Standards for Field Measurement and Instrumentation, Total System Balance, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.04 SUBMITTALS

- A. Certified Reports:
 - 1. Submit a minimum of six (6) copies of the testing report bearing the seal and signature of the Test Engineer and the name of the field technician who performed the work (if other than the Engineer).
 - 2. The reports shall be certified proof that the systems have been tested in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing procedures; and, are an accurate record of all final quantities measured.
 - 3. Follow the procedures and format herein specified.
- B. Report Contents: Provide the following minimum information, forms and data:
 - 1. Provide General Information and Summary information inside the cover sheet to identify testing Contractor, Owner's representative who witnessed the testing, Engineer and Project. Include addresses and contact names and telephone numbers. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

2. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared SMACNA for each respective item and system. Including:
 - a. Duct section tested.
 - b. Design CFM of tested section.
 - c. Duct area (square footage).
 - d. Design allowable leakage CFM
 - e. Design allowable leakage percentage
 - f. Measured duct pressure
 - g. Measured actual duct leakage CFM

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 REQUIRED SYSTEMS

- A. Stair and elevator shaft pressurization systems.

3.02 PROCEDURAL REQUIREMENTS

- A. Segments of duct systems may be pressure tested as construction permits (in lieu of the entire air distribution system at project completion). The test report shall identify each air distribution system tested and each segment if tested separately.
- B. The sheet metal contractor shall provide all labor and material required to cap segments of the duct systems, including at fans, at air handling units and at air terminal units (boxes).
- C. The supply ductwork downstream from air terminal units (boxes) shall be sealed, but shall not be pressure tested.

3.03 DUCT LEAKAGE TESTING

- A. The Certified Testing and Balancing Agency shall test and verify tightness of the duct systems as installed under this contract and specifications. The Certified Agency shall conduct all tests in accordance with the AABC or NEBB, National Standards for Field Measurement and Instrumentation. Four (4) copies of the leakage test results shall be submitted to the Architect prior to any duct being concealed by insulation or ceilings or completion of any project "phase".
- B. The leak test shall be carried out separately and recorded for each duct system. Maximum allowable leakage is as follows:
 1. $F = C_L * P^{0.65}$
 - a. F = Max Leakage (cfm/100 ft²)
 - b. C_L = Leakage Class (see Table 23 03 40.1)
 - c. P = Pressure (in H₂O)

Table 23 03 40.1

Duct Class	Rectangular Metal Duct Leakage Class (C _L)	Round Metal Leakage Class (C _L)
1/2-, 1-, 2-in wg	24	12
3-in wg	12	6
4-, 6-, 10-in wg	6	3

- C. Testing pressure shall be equal to the pressure classification to which the duct was constructed.
- D. Test equipment shall consist of:
 - 1. Air blower having minimum capacity of 4% of the total system air quantity for high pressure systems and 10% of the total system air quantity for low pressure systems.
 - 2. Orifice plate or other calibrated acceptable airflow measuring device for a range of 0.1% to 0.2% of the system capacity.
 - 3. Two gauges, one to read the duct S.P. in inches w.g. and the other to read the airflow (except if direct reading instruments are used).
 - 4. Dampening device or other provision to raise duct static pressure (SP) in inches water gauge to the required level.
 - 5. The test equipment shall be installed in a package and shall have approval regarding its capacity. Also, it shall include all ancillary parts (not listed above) required to provide the testing, e.g. flexible connection, extension cord, starter, pilot light, etc.
- E. Test procedure shall follow the outline given below:
 - 1. Use the "as-built" drawings to calculate the sheetmetal areas, air capacity and indicate the allowable leak in CFM on a chart. Select the proper airflow measuring device, size of orifice, etc., and show on the same chart. Provide space also for the final leak and duct S.P. recording.
 - 2. The Sheet Metal Contractor shall close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
 - 3. Start the blower with its control damper closed.
 - 4. Gradually open the inlet damper until the required duct pressure is reached.
 - 5. Hold this pressure for ten minutes. This brief overloading should reveal marginally constructed joints. Survey all joints for audible leaks. Mark each leak for repair by Sheet Metal Contractor after shutting down the blower. Do not apply a retest until sealants have set.
 - 6. Read the pressure differential across the orifice or other measuring device and compare the data with the CFM chart of the testing device, also the chart prepared for allowable leakage. If CFM is exceeded, further sealing is necessary.
 - 7. Request leak test certification from the manufacturer of the terminal boxes. If this is not available, then carry on the test at random for one of each size terminal unit by blocking off the low pressure side of the outlets. Proceed the same way as described above.

END OF SECTION 23 03 40

**SECTION 23 04 20
PAINTING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies painting requirements for this division and includes descriptions of piping and systems included as part of this division's contract and general application methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. Finishing (paint, wall covering, etc.) shall not be included under this Section.

PART 2 PRODUCTS

2.01 GENERAL

- A. All painted metal surface shall be primed and painted with paint. Apply painting to the following areas utilizing Sherwin-Williams materials:
 - 1. Ferrous Metal (Exterior): One coat Galvite HS and two coats All Surface Alkyd Enamel.
- B. Equipment touch up painting shall match the equipment finish.
- C. See Part 3 – Execution for piping, supports and equipment to be painted.

2.02 ACCEPTABLE MANUFACTURERS

- A. Painting shall be done with products as manufactured by Pittsburgh Plate Glass, Sherwin-Williams, Pratt and Lambert or Glidden.

PART 3 EXECUTION

3.01 LOCATIONS REQUIRING PAINTING

- A. General:
 - 1. Exposed iron work, hangers, pipe, pipe covering, equipment casings or enclosures, tanks, and ductwork exterior to mechanical equipment rooms.
 - 2. Where equipment is complete with a factory finish, additional painting is not required unless directed by the Architect/Engineer (requiring a color change).
 - 3. "Exposed" as indicated above, shall refer to exposed to view and shall not include piping or materials concealed above ceilings, under floor slabs, or buried in walls.
- B. All exposed hydronic piping serving cabinet unit heaters in stairwells and fin-tube radiators:
 - 1. Color selection to match adjacent building features and surroundings. Final color selection shall be made by the Architect/Engineer.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Materials and equipment installed under this Division shall be left free from dirt, grease and foreign matter, ready for painting.
- B. No equipment or piping shall be painted before being tested.
- C. Damaged surfaces of prefinished materials and equipment shall be touch-up painted to match existing finish.
- D. Comply with manufacturer's recommendations for mixing and application.
- E. Do not paint over name plates, labels, identification tags, signs, markers, etc.
- F. Surface preparation shall comply with SSPC-SSP2.

3.03 FIELD QUALITY CONTROL

- A. Provide protective drop coverings for all permanent finishes and surfaces while applying paint and until the final coating has dried to protect from excess paint spills, drips, etc.

3.04 CLEANING

- A. Clean excess paint from any surfaces not meant to be painted.
- B. Remove protective coverings once final paint coat has dried.

END OF SECTION 23 04 20

**SECTION 23 04 40
CONCRETE EQUIPMENT PADS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The other Specs of this Division complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the acceptable materials and installation methods to provide housekeeping pads, curbs, rails, inertia bases, etc., for equipment furnished under this Division.
- B. Furnish all equipment, materials, labor, and supervision necessary to provide cast-in-place concrete housekeeping pads, curbs, rails, inertia bases, etc., as described herein and where indicated on the drawings. Extent of mechanical related work required by this Section is indicated on the drawings.

1.03 QUALITY ASSURANCE

- A. Concrete Work Codes and Standards: Comply with governing regulations and, where not otherwise indicated, comply with industry standard in its application to work in each instance.
 - 1. ACI 301 "Specifications for Structural Concrete Buildings."
 - 2. ACI 381 "Building Code Requirements for Reinforced Concrete."
 - 3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

1.04 SUBMITTALS

- A. Operation and Maintenance (O&M) Manuals
 - 1. Provide manuals, per requirements of Section 23 01 10.

1.05 PROJECT CONDITIONS

- A. Protect adjacent finish materials against spatter during concrete placement.

PART 2 PRODUCTS (NOT APPLICABLE)

2.01 CONCRETE RELATED MATERIALS

- A. Forms for exposed finish concrete work shall be of lumber, metal, metal-framed or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
 - 1. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
 - 2. Welded Wire Reinforcing Fabric: ASTM A 185, welded steel wire fabric.
 - 3. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place.

2.02 CONCRETE MATERIALS

- A. Materials for concrete work shall comply with requirements of other Divisions "Portland Cement Concrete Paving" Section.
- B. Portland Cement: ASTM C 150, Type I.
- C. Use one brand of cement throughout project, unless otherwise acceptable to Architect. Prepare design mixes for each strength of concrete indicated.
 - 1. Fly Ash: ASTM C 618, Type C or Type F.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Course Aggregate: ASTM C 33, crushed gravel.

2.03 DESIGN AND PROPORTIONING OF CONCRETE MIXES

A. General:

1. Design mechanical work concrete as follows, for each 28-day compressive strength class:
 - a. 3000 psi Class: 500lbs. of cement per cubic yard (5.25 sacks) and 0.46 water/cement ratio.

PART 3 EXECUTION

3.01 INSTALLATION OF CONCRETE

A. Formwork:

1. General: Design, construct, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so that formed concrete will be of required size, shape, alignment, elevation, and position.
 - a. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates furnished by equipment manufacturers, to locate anchor bolts, or where not furnished, locate by accurate measure from certified setting diagrams.

B. Placing Reinforcement:

1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI's "Manual of Standard Practice."

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

D. Chamfer exposed corners and edges using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

E. Provisions for Other Trades:

1. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support built into forms.

F. Cleaning and Tightening:

1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Re-tightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.

G. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

H. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

I. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.02 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

- B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.03 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 24 hours after placing concrete, provided concrete sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

3.04 CONCRETE PLACEMENT

- A. Pre-placement inspection:
 - 1. Before placing, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where coatings are not used.
- B. General:
 - 1. Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
- C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- D. Consolidate placed concrete by mechanical vibrating equipment supplemented by handspading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
- E. Placing Concrete Slabs:
 - 1. Deposit and consolidate slabs in a continuous operation within limits of construction joints, until the placing of a panel or section is completed.
- F. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- G. Bring slab surfaces to correct level with straightedge and strike-off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- H. Maintain reinforcing in proper position during concrete placement operations.

3.05 CONCRETE CURING AND PROTECTION

- A. General:
 - 1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
- C. Begin final curing procedures immediately initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
 - 1. Cold Weather Placement:

- a. Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40°F (4.4°C), heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (26.7°C), at time of placement. Protect concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.
2. Finishing Horizontal Surfaces:
 - a. Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struck-off surface undisturbed, except scratch surfaces which are to receive concrete or mortar topping or setting bed, by ranking with a stiff broom.

3.06 MISCELLANEOUS CONCRETE ITEMS

- A. Curbs:
 1. Provide monolithic finish on interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to hard, dense finish with corners, intersections and terminations slightly rounded and coved.
- B. Equipment Bases and Foundation:
 1. Provide equipment bases and foundations, as shown on drawings. Set anchor bolts for equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing equipment.
- C. In the absence of more specific information, either on the drawings, or in manufacturer's literature, concrete bases shall be level, shall have a minimum height above finished floor of 4" and extend 3" beyond the skids, feet or bed plate of the item of equipment.
- D. Concrete pads, pedestals, or saddles placed in existing structures shall be mounted securely to the original substrate with anchor bolts.
- E. Grout base plates and foundation as indicated, using non-shrink grout. Use non-metallic grout for exposed conditions.

3.07 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas:
 1. Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.
- B. Cut out honeycomb, rock pockets, voids over ¼" in any dimension, and holes left by tie rods, and bolts, down to solid concrete but, in no case to a depth of less than 1 qt. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar after bonding compound has dried.
 1. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
 2. Exposed Surfaces: On formed which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with gout and completely removing fins and other projections.

3.08 DELIVERY, STORAGE, HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

3.09 CLEANING

- A. Clean area after pad has cured of left-over or spilled concrete, dust, or other materials on-site to facilitate concrete mixing and pouring.

END OF SECTION 23 04 40

SECTION 23 05 10
ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The other Division 23 Specifications complement the requirements of this Section. Separate electrical components and materials for field installation and electrical connections are specified in Division 26.
- B. The other Division 23 Specifications complement the requirements of this Section.
- C. Separate electrical components and materials for field installation and electrical connections are specified in Division 26.

1.02 SCOPE

- A. This Section specifies basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings or described in other Sections of Division 23.
- C. Provide all materials, equipment, labor and supervision necessary to install all electrical components and devices described in this Section.
- D. All field wiring of components and devices described in this Section shall be by the Electrical Contractor as specified in Division 26.

1.03 CODES AND STANDARDS

- A. All motors, electrical devices and enclosures shall comply with NEMA and IEEE Standards for the specific application in which installed.
- B. Electrical components and integral wiring shall comply with the National Electrical Code (NFPA 70).
- C. Electrical components and materials shall be UL labeled.

PART 2 PRODUCTS

2.01 GENERAL

- A. All HVAC equipment control panel and electrical device enclosure covers shall be provided with defeatable interlocks to permit opening of panel (by qualified personnel) while equipment is in operation.
- B. Fabricate HVAC equipment for secure mounting of motors and other electrical items integral with the equipment. Provide either permanent alignment of motors with equipment or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives, arranged for lubrication and similar running-maintenance without removal of guards. Guards shall include opening for insertion of revolution counter at motor drive sheave.

2.02 MOTORS

- A. For each item of equipment requiring electric drive, provide an induction motor having starting and running characteristics consistent with the torque and speed requirements of the driven equipment. In no case shall power requirements of the driven equipment exceed the nominal nameplate rating of the furnished motor (do not take advantage of service factors in selecting motors). For design, construction and performance characteristics, conform to applicable provisions of latest NEMA and IEEE standards for rotating electrical equipment.

- B. Unless otherwise specified, motors are to be general-purpose open-drip proof type, with Class B insulation, rated for continuous operation in 40°C ambient temperature. All motors utilized with variable frequency drives shall be "inverter ready" motor with class F insulation in accordance with NEMA MG1 Part 31.4.4.2. All motors utilized with variable frequency drives shall be provided with a shaft ground ring in compliance with NEMA MG1 31.4.4.3.
 - 1. Unless otherwise scheduled on the drawings, motors 1/2 HP and smaller shall be single phase, capacitor start type, with ball bearings. Shaded-pole type with sleeve bearings are acceptable only for motors less than 1/16 HP.
 - 2. Unless otherwise scheduled on the drawings, motors 3/4 HP and larger shall be three phase, squirrel-cage type with ball bearings.
 - 3. Ball bearings shall be regreasable, except where motor is normally inaccessible for regular maintenance, permanently sealed ball bearings shall be provided.
- C. Motors shall have a minimum efficiency as follows in accordance with IEEE Standard 112, test method B. If horsepower is not listed, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112, test method B.
- D. Motors shall be furnished with stainless steel nameplate indicating manufacturer, ratings, characteristics, construction, efficiency and special features.
- E. Acceptable motor manufacturers: A.O. Smith, Baldor (Reliance), Emerson, General Electric, Leeson, Louis Allis, Marathon Electric, Teco-Westinghouse.

2.03 MANUAL MOTOR STARTERS

- A. In general, single phase motors shall be equipped with manual motor starters. Manual motor starters shall be provided and installed by the electrical contractor as specified in Division 26 unless noted otherwise on the Division 23 drawings or in the Division 23 specifications.
- B. Enclosures in dry indoor locations shall be general purpose NEMA Type 1, unless noted otherwise. Enclosures in wet indoor or outdoor locations shall be NEMA Type 4 (stainless steel, unless noted otherwise).
- C. Manual motor starter shall include neon pilot light, "Quick-make, quick-break" trip-free toggle mechanism and melting alloy thermal overload relay sized to protect the motor.

2.04 COMBINATION MOTOR STARTERS

- A. In general, three phase motors shall be equipped with combination motor starters. Combination motor starters shall be provided and installed by the electrical contractor as specified in Division 26 unless noted otherwise on the Division 23 drawings or in the Division 23 specifications.
- B. Enclosures in dry indoor locations shall be general purpose NEMA Type 1, unless noted otherwise. Enclosures in wet indoor or outdoor locations shall be NEMA Type 4 (stainless steel, unless noted otherwise).
- C. Size of starters shall be as recommended by the motor or driven equipment manufacturer.
- D. Combination motor starters shall include a disconnect as specified in the following section "2.5 Disconnect Switches". Starter shall be furnished with the following devices:
 - 1. "HAND-OFF-AUTO" selector switch in cover.
 - 2. Heavy duty push-to-test red pilot light to illuminate when motor is running.
 - 3. Control power transformer (coordinate secondary voltage with required control voltage). Control transformer primary shall be connected to the load side of the incoming line disconnect fuses and the secondary shall be fused and grounded.
 - 4. Three (3) bi-metal type thermal overload elements. The starter shall be inoperative if any thermal element is removed.

5. Minimum of two NO/NC field convertible auxiliary contacts. Two NO and two NC contacts may be furnished in lieu of convertible contacts.
6. Engraved nameplate on the door describing the equipment controlled.

2.05 DISCONNECT SWITCHES

- A. Disconnect switches shall be provided and installed by the electrical contractor as specified in Division 26 unless noted otherwise on the Division 23 drawings or in the Division 23 specifications.
- B. In dry indoor locations, enclosures shall be general purpose NEMA Type 1, unless noted otherwise. In wet indoor or outdoor locations enclosures shall be NEMA Type 4 (stainless steel), unless noted otherwise.
- C. Size of disconnect switches shall be as recommended by the motor or driven equipment manufacturer.
- D. Disconnect switches shall be fusible type, with Class R rejection fuse clips.
 1. The disconnect handle shall always be in control of the disconnect device with the door open or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "ON" or "OFF", and shall include a two-color handle grip, the black side visible in the "OFF" position indicating a safe condition, and the red side visible in the "ON" position indicating a dangerous condition.
 2. Disconnect handle shall contain provisions for padlocking in the "OFF" position.
 3. If required, the disconnect switch shall be furnished with one auxiliary SPDT contact for use by the Controls Contractor to de-energize remotely powered interlock wiring when the disconnect is in the "OFF" position.
- E. Disconnect switches shall be furnished with a ground lug.

PART 3 EXECUTION

3.01 GENERAL INFORMATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 HP and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Install starters and wiring devices at location indicated, securely supported and anchored, and in accordance with manufacturer's installation instructions. Locate for proper operational access, including visibility, and for safety.
- C. Install power and control connections for motors to comply with NEC and applicable provision of Division 26 sections. Install grounding except where non-grounded isolation of motor is indicated.
- D. Prior to the purchase or installation of any equipment, verify all motor voltage characteristics with the Electrical Contractor.
- E. Make final electrical connection to all motors with flexible metal conduit unless plug-in electrical cords are specified. Line voltage terminations shall be by the Electrical Contractor.

END OF SECTION 23 05 10

**SECTION 23 05 20
VARIABLE FREQUENCY DRIVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies variable frequency drives (VFD's) utilized to control the speed of specific motor driven mechanical equipment and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. Specific electrical requirements (i.e., horsepower and electrical characteristics) for mechanical equipment are specified herein and scheduled on the drawings.
- D. All variable frequency drives that are not an integral part of packaged equipment, shall be furnished by the Contractor designated on the drawings and installed/set/wired by the Electrical Contractor unless otherwise noted as furnished by others.

1.03 CODES AND STANDARDS

- A. All variable frequency drives, including installation, shall comply with the requirements of the National Electric Code and the local authorities having jurisdiction.
- B. UL Compliance: Provide VFD's that are UL listed and approved.
- C. NEMA Standards ICS 7.1 – 2006: Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems.
- D. NEMA Standards MG 1: Motors and Generators.
- E. NEMA Standards ICS 2: Industrial Control Devices, Controllers and Assemblies.
- F. NEMA Standard 250: Enclosures for Electrical Equipment.
- G. NEMA Standard KS 1: Enclosed Switched.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of VFD's, of types and capacities required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. To ensure quality and minimize infantile failures at the jobsite, the complete VFD assembly (including options) shall be tested by the drive manufacturer. The complete drive assembly shall be manufactured in an ISO 9001 certified facility.
- C. All optional features shall be functionally tested at the factory for proper operation.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle VFD's and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage. Retain shipping protective covers and protective enclosures during storage.
- B. Store VFD's and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage. Retain shipping protective covers and protective enclosures during storage.
- C. Each VFD shall be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD's shall not be operated while covered.

1.06 SUBMITTALS

- A. Shop Drawings: Provide Shop Drawings, per requirements of Sections 23 01 10 and 23 01 20.
- B. Operation and Maintenance (O&M) Manuals: Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report: Provide completed start-up form, per the requirements of Section 23 03 20.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide variable frequency drives as manufactured by one of the following:
 - 1. ABB Inc.
 - 2. Eaton
 - 3. Danfoss
 - 4. Square D
 - 5. Yaskawa
- B. Motors shall be inverter duty rated, per NEMA MG1 parts 30 and 31, for motor-drive compatibility.

2.02 GENERAL

- A. Furnish complete variable frequency drives as specified herein for the fans and pumps designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified.
 - 1. In dry indoor locations, VFD shall be housed in a metal NEMA 1 enclosure.
 - 2. In wet indoor locations, VFD shall be housed in a metal NEMA 12 ventilated enclosure.
 - 3. In outdoor locations, VFD shall be housed in a painted steel NEMA 3R ventilated enclosure with thermostatically controlled space heater.
- B. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to negate the need for motor derating.
- C. An advanced sine wave approximation and voltage vector control shall be used to allow operation at rated motor shaft output at nominal speed with no derating. This voltage vector control shall minimize harmonics to the motor to increase motor efficiency and life.
- D. The VFD shall include a full-wave diode bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
- E. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL-508 certified for the building and assembly of option panels. Local representative panel shop assembly for option panels is not acceptable. The appropriate UL stickers shall be applied to both the drive and option panel, in the case where these are not contained in one panel.
- F. The VFD's full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

- G. The VFD shall be able to provide full torque at any selected speed up to base speed to allow driving direct drive fans without derating.
- H. An automatic energy optimization selection feature shall be provided standard in the drive. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide a 3% to 10% additional energy savings.
- I. The AC drive power converter shall be protected against short circuits between output phases and also phase-to-ground. Installing Contractor shall supply auxiliary switches on all output disconnecting devices. Auxiliary devices shall be wired to the drives enable circuits, such that opening such device will disable the drives output.
- J. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or decouple the motor from the load to run the test.
- K. The VFDs shall include Electromagnetic interference (EMI) and radio frequency interferences (RFI) filters. The EMI/RFI filter shall allow the VFD assembly to meet ISO product standard EN 61800-3. The EMI filters shall be removable to facilitate installation into a high leg (delta) or High Resistance Grounded power systems.

2.03 PROTECTIVE FEATURES

- A. Class 20 I²t electronic motor overload protection for single motor applications and thermal-mechanical overloads for multiple motor applications.
- B. Protection against input transients, loss of AC line phase, short circuit, ground fault, overvoltage, undervoltage, drive overtemperature and motor overtemperature. The VFD shall display all faults in plain English. Codes are not acceptable.
- C. Protect VFD from sustained power or phase loss. VFD must operate, without fault or failure, when voltage varies plus or minus 10% from rating and when frequency varies plus or minus 5% from rating.
- D. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
- E. Drive shall have semi-conductor rated input fuses to protect power components or, if furnished without fusing, shall be certified and agency tested to provide a minimum withstand rating of 100,000 amp interrupting capacity (AIC) while operating from the VFD or while operating in bypass.
- F. To prevent breakdown of the motor winding insulation, the dV/dt must be below 1500 V/msec per IEC recommendations. The supplier shall include with the quotation the dV/dt values of the drive. For each 480V application, provide the following filters:
 - 1. Drive and motor are 0-50 feet apart: no filter.
 - 2. Drive and motor are 50 to 300 feet apart: provide a 3% load reactor.
 - 3. Drive and motor are 300 to 1000 feet apart: provide a TCI Model V1K, dV/dt filter located on the output of the drive. The filter V1K filter shall be sized to the horsepower and voltage rating of the VFD and furnished in a NEMA 1 enclosure.
 - 4. Drive and motor are 1000 feet or more apart: provide a Sine Wave Filter.
 - 5. The total length for Drives that serve multiple motors shall not exceed 100 feet. The length shall be calculated as the total sum of lengths between each motor overload and the motor itself. Filter may be furnished integral in the VFD drive enclosure or in a separate NEMA 1 enclosure. Where this specification applies to any retrofit of an existing motor a TCI Model V1K dV/dt filter shall be required regardless of motor cable length.

- G. Drive shall include a "signal loss detection" circuit to sense the loss of the control signal, and shall be programmable to react as desired in such instance.
- H. The AC drive power converter shall be protected against short circuits between output phases and also phase-to-ground. Installing Contractor shall supply auxiliary switches on all output disconnecting devices. Auxiliary devices shall be wired to the drives enable circuits, such that opening such device will disable the drives output.
- I. Drive shall catch a rotating motor operating forward or reverse up to full speed.
- J. VFD shall be rated for 100,000 AIC.
- K. Drive shall include motor phase loss protection. Drive shall also display the associated fault.
- L. Drive shall continue to operate without faulting until input voltage exceeds 300 volts on 208/230 volt drives, and 604 volts on 460 volt drives.

2.04 INTERFACE FEATURES

- A. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the drive and determine the speed reference.
- B. Provide a 24 V DC output signal to indicate that the drive is in Auto/Remote mode.
- C. Digital manual speed control. Potentiometers are not acceptable.
- D. Lockable, alphanumeric backlit display keypad can be remotely mounted up to 10 feet away using standard 9-pin cable. All keypads shall be identical and interchangeable. Drive may be operated with keypad removed. All drives shall use the same control keypad.
- E. To setup multiple drives, it shall be possible to upload all setup parameters to the drive's keypad, place that keypad on all other drives in turn and download the setup to each drive.
- F. The display shall have four lines, with 20 characters on three lines and eight large characters on one line.
- G. Two lines of the display shall allow free programming so that the exact unit controlled by the drive can be identified.
- H. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided on approved manufacturer's standard keypad display. These indications shall be visible both on the keypad and on the drive when the keypad is removed.
- I. A quick setup menu with factory preset typical HVAC parameters shall be provided on the drive eliminating the need for macros.
- J. Two set-point control interface (PID control) shall be standard in the unit or approved manufacturer's standard programming. Drive shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
- K. Floating point control interface shall be provided to increase/decrease speed in response to switch closures.
- L. Sleep mode shall be provided to automatically stop the drive when speed drops below set "sleep" level for a specified time. Drive automatically restarts when speed command exceeds set "wake" level.
- M. Run permissive circuit shall be provided to accept a "system ready" signal to assure that the drive does not start until dampers or other auxiliary equipment are in the proper state for drive operation.
- N. An elapsed time meter and kWh meter shall be provided.
- O. The following displays shall be accessible from the control panel in actual units: Reference Signal Value in actual units, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, No Load Warning, DC Bus Voltage, Drive Temperature in degrees, and Motor Speed in engineering units per application (in percent speed, GPM, CFM,...). Drive will read out the selected engineering unit either in a linear, square or cubed relationship to output frequency as appropriate to the unit chosen.

- P. Up to four meter displays can be shown at once on the display. This allows the actual value of the follower signal to be shown simultaneously with the drive's response to that signal for ease in commissioning.
- Q. Drive will sense the loss of load and signal a no load/broken belt warning or fault.
- R. The VFD shall have approved manufacturer's standard drive temperature controlled cooling fans for quiet operation and minimized losses.
- S. The VFD shall store in memory the last 20 faults and record all operational data.
- T. Six programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
- U. Two programmable relay outputs, one Form C 240 V AC, one Form A 50 V AC, shall be provided for remote indication of drive status.
- V. Two programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include one voltage (0-10 V dc, 2 to 10 V dc) and one current (0 to 20 mA, 4 to 20mA) input.
- W. One programmable 0-20 mA analog output shall be provided for indication of drive status. This output shall be programmable for output speed, voltage, frequency, amps and input kW.
- X. Under fire mode conditions the VFD shall automatically default to a preset speed.

2.05 ADJUSTMENTS

- A. VFD shall have an adjustable carrier frequency.
- B. Seven preset speeds shall be provided.
- C. Two acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves may be automatically contoured to prevent tripping.
- D. Two current limit settings shall be provided.
- E. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit, and inverter overload.
- F. The number of restart attempts shall be selectable from 0 through 5 and the time between attempts shall be adjustable from 0 through 600 seconds.
- G. An automatic "on delay" may be selected from 0 to 120 seconds.

2.06 AUTOMATION SYSTEM INTERFACE

- A. The VFD's shall communicate directly with the Building Automation System through the local area network.
- B. The VFD's shall communicate directly with the Building Automation System through a BACNET compliant protocol/MODBUS/MODBUS EIA-485 card with a Serial communications port interface network. This connection to the system shall allow all operating parameters, speed control, drive configuration, and status of the drives to be both read and changed through the bus connection. Modulating signal, enable/disable, remote disconnect status and general alarm signals shall be hard wired.

2.07 BYPASS

- A. Where indicated, provide a manual bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a three position HAND/OFF/AUTO switch controlling three contactors. In the DRIVE position, the motor is operated at an adjustable speed from the drive. In the OFF position, the motor and drive are disconnected. In the HAND position, the motor is operated at full speed from the AC power line and power is disconnected from the drive so that service can be performed. A Customer supplied normally closed dry contact shall be interlocked with the drives safety trip circuitry to stop the motor whether in AUTO or HAND mode in case of an external safety fault.

2.08 DISCONNECT

- A. Provide a door interlocked, padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.

2.09 SERVICE CONDITIONS

- A. Ambient temperature, -10 to 40°C (14 to 104°F).
- B. 0 to 95% relative humidity, non-condensing.
- C. Elevation to 3,300 feet without derating.
- D. AC line voltage variation, -10 to +10% of nominal with full output.
- E. No side clearance shall be required for cooling of any NEMA 1 units, or of any NEMA 12 units of less.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust, and moisture of the environment. Separate conduit installation of the motor wiring, power wiring, and control wiring, and installation per the manufacturer's recommendations shall be verified.
- B. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.

3.02 INSTALLATION

- A. All variable frequency drives shall be furnished by the designated contractor and installed/set/wired by the Electrical Contractor unless otherwise noted.

3.03 WARRANTY

- A. The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

3.04 START-UP SERVICE

- A. The manufacturer shall provide start-up commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Sales personnel and other agents who are not factory certified technicians for VFD field repair shall not be acceptable as commissioning agents. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system. Start-up shall include customer operator training at the time of the equipment commissioning.
- B. The Balancing Contractor shall work with the variable frequency drive (VFD) manufacturer's start-up representative to determine all resonant frequencies found on VFD-driven fans and pumps through the entire operating range of the equipment. These resonant frequencies shall be noted in the balance reports and shall be programmed by the VFD technician for critical avoidance frequencies.

3.05 DEMONSTRATION AND TRAINING

1. Owner's Instructions: Provide services of a manufacturer's technical representative for two (2) separate 4-hour days to instruct Owner's personnel in operation and maintenance of variable frequency drives.

- a. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

END OF SECTION 23 05 20

**SECTION 23 07 10
PENETRATIONS AND SLEEVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section specifies basic requirements for wall, foundation wall, roof and floor penetrations.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. Underwriters' Laboratory (UL)
- B. ASTM E-84 (NFPA 255)

1.04 SUBMITTALS

- A. Slab-on-grade floor and below-grade wall penetrations seal: Submit manufacturer's cutsheet(s), including dimensions, materials, installation recommendations, ratings and code compliance information, etc.
- B. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 20.

PART 2 PRODUCTS

2.01 BELOW-GRADE WALL AND SLAB-ON-GRADE FLOOR PENETRATION SEAL

- A. Blow-grade mechanical seals shall consist of intumescent synthetic rubber plugs, plastic or stainless steel pressure plates, and stainless steel bolts.
- B. Subject to compliance with requirements, provide below grade wall and floor slab penetration seals as manufactured by one of the following:
 - 1. Metra-Flex
- C. Thunderline Corp

2.02 PIPE SLEEVE MATERIALS

- A. Schedule 40 black steel pipe.

2.03 SOUND-STOPPING MATERIALS

- A. Fiberglass insulation, 2 lb. density.
- B. Material shall be non-asbestos and non-friable.
- C. Provide all insulation materials with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

2.04 ESCUTCHEONS

- A. Escutcheons shall be two-piece, chrome plated brass.

PART 3 EXECUTION

3.01 GENERAL

- A. Pipe sleeves are required at all pipes penetrating concrete walls, masonry walls, fire walls and smoke barrier walls.
- B. Where concrete or masonry walls are core drilled for pipe passage, steel sleeves are not required.

- C. Where concrete floor slabs or concrete roof slabs are core drilled for pipe passage, steel sleeves are not required – except in mechanical rooms and all rooms containing water piping.
- D. In new concrete walls, floors, and roofs, coordinate the exact locations of pipe sleeves with the General Trades Contractor performing this work prior to concrete pour.
- E. Each Contractor is responsible to furnish and install his own pipe sleeves.

3.02 CUTTING AND PATCHING

- A. This Contractor shall provide all penetrations required for the installation of Ductwork, HVAC piping, conduit, and equipment. Do not cut any structural member without specific permission from the Architect.
- B. Penetrations shall be cut as small as practical with as little damage as possible and in a manner satisfactory to the Architect.
- C. This Contractor shall patch all penetrations and repair all damage caused by the installation and/or removal of plumbing systems. All materials shall be new and shall match the adjacent construction.
- D. Finishes (paint, wall covering, etc.) shall not be included under this Section.

3.03 MASONRY OR CONCRETE WALL BELOW-GRADE, AND FLOOR SLABS ON-GRADE:

- A. Sleeves shall be one inch (1”) larger than the outside diameter of the pipe including insulation where applicable, or two pipe sizes larger, whichever is bigger.
- B. Set pipe wall sleeves with ends of sleeves flush with wall faces. Set pipe floor sleeves with top of sleeve to be 4 inches above finished floor in water entry rooms, mechanical rooms, and wet floor locations.
- C. Center pipes in sleeves.
- D. Provide below-grade mechanical wall and floor penetration seals to fill the annular space between the pipe and floor slab or outside wall and sleeve. Center penetration seal within the opening.
- E. Comply with penetration seal manufacturer’s installation instructions.

3.04 MASONRY OR CONCRETE WALL ABOVE-GRADE

- A. Sleeves shall be one inch (1”) larger than the outside diameter of the pipe including insulation where applicable, or two pipe sizes larger, whichever is bigger.
- B. Set pipe sleeves with ends of sleeves flush with wall faces.
- C. Center pipes in sleeves.
- D. For fire or smoke rated walls, fill the annular space between the pipe and the sleeve with the proper firestopping material. See “Firestopping” specification section, this Division for products and installation methods.
- E. For unrated walls, fill the annular space between the pipe and the sleeve with sound stopping.

3.05 CONCRETE FLOOR OR ROOF:

- A. Sleeves shall be 1 inch larger than the outside diameter of the pipe, or two pipe sizes larger, whichever is bigger.
- B. Set pipe sleeves with top of sleeve flush with roof slab or deck surface.
- C. Set pipe sleeves with top of sleeve to be 4 inches above finished floor in water entry rooms, mechanical rooms and wet floor locations.
- D. Center pipes in sleeves.
- E. For fire or smoke rated floors and roofs, fill the annular space between the pipe and the sleeve with the proper firestopping material. See “Firestopping” specification section, this Division for products and installation methods.

- F. For unrated floors and roofs, fill the annular space between the pipe and the sleeve with sound stopping. Note – roof penetrations shall be made via roof curbs.

3.06 SOUND STOPPING

- A. Where pipes or other components of Division 23 work pass through non-fire rated walls, provide sound stopping between such work and the wall material intended to reduce the transmission of sound from on side of the wall to the other.
- B. Sound stopping of pipes in sleeves shall consist of sealing the outside of the sleeve with caulking and the inside with an insulating material.
- C. Sound stopping of pipes without sleeves shall consist of packing the cavity around the penetration with an insulating material and sealing the opening with approved sealant or plaster.
- D. Insulating materials shall be non-asbestos and non-friable, and shall have a flame spread rating of no more than 25 and a smoke developed rating of no more than 50.

3.07 ESCUTCHEONS

- A. Fit all pipe passing exposed through walls, floors, or ceilings in finished rooms with chrome-plated brass escutcheons. Where adjacent surface is to receive a paint finish, prime paint escutcheons, otherwise escutcheons shall be chrome plated.

END OF SECTION 23 07 10

**SECTION 23 07 11
ROOF PENETRATION CURBS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies roof curbs and rails utilized to support and elevate equipment above roofs. To insure compatibility, roof curbs, rails and supports should be furnished by the rooftop equipment manufacturer, wherever possible, in compliance with this Section.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Roof curbs and support rails furnished by the rooftop equipment manufacturer shall be submitted with the equipment.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver roof curbs and support rails in factory-fabricated crates, containers or wrapping which properly protect roof curbs and support rails from damage.
- B. Store roof curbs and support rails in original packaging and protect from weather and construction traffic. Whenever possible, store indoors. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle roof curbs and support rails carefully to prevent damage, breaking, denting and scoring of finishes. Do not install damaged units or components; replace with new.

1.05 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of roof curbs, equipment supports and roof penetrations with the General Contractor.
- B. Coordinate the size and location of structural steel support members.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide prefabricated roof curbs manufactured by one of the following:
 - 1. Custom Curb, Inc.
 - 2. Pate Co.
 - 3. Roof Products & Systems Corp.
 - 4. ThyCurb Div.; Thybar Corp.
 - 5. Associated Rooftop Equipment Manufacturer

2.02 ROOF ACCESSORIES

- A. Roof flashings for HVAC equipment are specified elsewhere in this Division of the Specifications.

2.03 ROOF EQUIPMENT, PIPING AND DUCT SUPPORTS

- A. Fabricate roof curbs and roof support curbs from zinc-coated steel, ASTM A 146, Grade C, designation G90 hot-dip coating, mill phosphatized. Clean and paint with rust-inhibitive metal primer paint of type recommended by manufacturer, 2.0 mils dry film thickness.
- B. Reinforce continuous runs of over 3'-0" length, by inserting welded stiffeners of heavy gauge with flanges as required to provide sufficient rigidity and strength to withstand maximum lateral forces in addition to superimposed vertical loads.
- C. Fabricate curbs of minimum 18 gauge galvanized metal and to a minimum height above roof surface of 12".
- D. Provide pressure treated wood nailer, not less than 1-5/8" thick and of width indicated, but not less than width of support wall assembly. Anchor nailer securely to top of metal frame unit. Wood shall be pressure treated with water-borne preservatives for "above ground" use, complying with AWPB LP-2.
- E. Insulate curb's inside structural support wall with rigid glass fiber insulating board of approximately 3 lb. density and 1½" minimum thickness, except as otherwise indicated.

2.04 PIPING PENETRATION ROOF CURBS

- A. All roof piping curbs shall be sealed watertight utilizing an ABS thermoplastic KORAD acrylic cover. Cover shall contain molded, graded boots of quantity and sizes to accommodate roof piping penetrations controls conduit and electrical conduit as indicated. Provide two (2) stainless steel pipe clamps per boot. Covers shall be as manufactured by the same manufacturer as roof curbs.

2.05 NON-INVASIVE SUPPORTS

- A. Acceptable Manufacturers:
 - 1. Furnish non-invasive supports as manufactured by one of the following acceptable manufacturers:
 - a. Miro
 - b. Erico
 - c. Cooper B-Line
 - d. Mifab
 - e. Rooftop Support Systems
- B. Non-invasive pipe supports shall support piping above the roof with support not incorporated into the roofing system. Base shall be composed of crumb rubber with urethane binding agent compression molded on a hydraulic press. Fixing hardware shall be nickel plated steel/hot dip galvanized steel/pre-galvanized steel/304 stainless steel/powder coated channel. "Roller Bearing" pipe supports shall be provided where indicated above.

PART 3 EXECUTION

3.01 ROOFING WORK

- A. Coordination
 - 1. Coordinate the type of roofing materials and approved penetration methods with the General Contractor prior to making penetrations. Provide components and installation as specified below or as directed by the General Contractor.
 - 2. The Mechanical Contractor shall locate all roof mounted equipment and roof penetrations. The General Contractor shall provide all roof openings and shall perform all roofing work required to incorporate roof curbs into roofing system.
- B. Roof Curbs and Roof Equipment Supports

1. Where supports or curbs are not specified with mechanical equipment; provide prefabricated equipment supports or curbs for roof mounted equipment.
2. Where pipes penetrate the roof provide prefabricated pipe curb assemblies or pipe seals.
3. Coordinate requirements with the electrical contractor and controls contractor and provide openings in curbs to accommodate electrical and controls conduits.

END OF SECTION 23 07 11

**SECTION 23 07 20
FIRESTOPPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section specifies firestopping materials and installation requirements for the penetration of rated assemblies. Portions of this Section may not be required in this project. Actual field conditions, penetration type (pipe, duct, conduit, etc.) and assembly type, shall define exact firestopping requirements.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. The firestop system installation shall be UL Listed and tested in accordance with ASTM E814.
- B. Fire rating of the firestop system shall be equivalent to the assembly which is penetrated.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- 1. Subject to compliance with requirements, provide firestopping as manufactured by one of the following:
 - a. Hilti, Inc.
 - b. 3M; Fire Protection Products Division.
 - c. Thermafiber Safing
 - d. Specified Technologies Inc.
 - e. FireTrak Corp.

2.02 MATERIALS

- A. All products used under this Section shall be UL listed for the purpose.
- B. Piping, ductwork, and sleeve penetrations of rated assemblies shall be sealed with the appropriate intumescent caulk, putty, strip, block, or sheet type fire barrier product.
- C. Fire barrier products shall be installed in accordance with all U.L. System requirements for the type of penetration and firestopping system used. The following U.L. System descriptions are those of Hilti Inc. firestopping systems.

Table 23 07 20.1

Penetration (F rating)	UL System
Metal pipe through gypsum board (1 or 2 hour)	Hilti UL #WL1054 or approved equal

Penetration (F rating)	UL System
Metal pipe through masonry/concrete (2 hour)	Hilti UL #CAJ1291 or approved equal
Metal pipe through poured concrete floor slab (3 hour)	Hilti UL #FA1017 or approved equal
Insulated metal pipe through gypsum board (1 or 2 hour)	Hilti UL #WL5029 or approved equal
Insulated metal pipe through masonry/concrete (2 hour)	Hilti UL #CAJ5091 or approved equal
Insulated metal pipe through poured concrete floor slab (2 hour)	Hilti UL #FA5017 or approved equal
Plastic pipe through gypsum board (1 or 2 hour)	Hilti UL #WL2078 or approved equal
Plastic pipe through masonry/concrete (2 hour)	Hilti UL #CAJ2271 or approved equal
Plastic pipe through poured concrete floor slab (3 hour)	Hilti UL: #FA2054 or approved equal
Metal duct without fire damper through Gypsum board (1 or 2 hour)	Hilti UL #WL7040 OR #WL7042 or approved equal
Metal duct without fire damper through masonry/concrete (1 or 2 hour)	Hilti UL #WJ7021 OR #WJ7022 or approved equal

1. Actual project conditions may require a UL System not specifically described above. Fire barrier products manufacturer shall provide a UL System to meet actual project conditions

PART 3 EXECUTION

3.01 GENERAL

- A. All penetrations (pipe, duct, conduit, etc.) through fire rated assemblies shall be firestopped.
- B. All firestopping materials shall be installed per the manufacturer's instructions.
- C. Examine the areas and conditions where firestops are to be installed and notify the Engineer of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the Architect.
- D. Unused sleeves or core drilled holes shall be plugged with fire resistant material and finished to match adjacent surfaces.
- E. Finish surfaces of firestopping, which are to remain exposed to view, to a uniform and level condition.
- F. Field Quality Control
 1. All areas of work must be accessible until notification and inspection by the applicable Code authorities.
 2. Have firestops examined by proper authorities to ensure proper installation and full compliance with this specification. If required, show proof of compliance by providing the appropriate UL firestopping system number.
 3. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.
- G. If requested, the Contractor shall show proof of compliance by providing the appropriate UL firestopping system number to the inspection Authority Having Jurisdiction or the Engineer.

END OF SECTION 23 07 20

**SECTION 23 07 30
MISCELLANEOUS STEEL AND SUPPORTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section describes the materials, fabrication, and installation requirements miscellaneous steel supports, structures, and reinforcements required for the proper installation of mechanical systems and equipment.
- B. Furnish all material, equipment, labor, and supervision necessary to provide steel supports, structures, and reinforcements as required in by this division of the specifications and as called for on the drawings.

1.03 CODES AND STANDARDS

- A. Ohio Building Code
- B. Ohio Mechanical Code
- C. Design all miscellaneous steel in accordance with AISC Steel Handbook

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION 23 07 30

**SECTION 23 08 10
VIBRATION ISOLATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies vibration isolation products and includes general description and installation methods.
- B. Vibration isolation products furnished as an integral part of factory fabricated equipment are specified as part of the equipment in other sections of Division 23.
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Except as otherwise indicated; obtain vibration isolation products from a single manufacturer.
- B. Engage manufacturer to provide proper selection and technical supervision of installation of vibration control products.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide isolators as manufactured by one of the following:
 - 1. Amber Booth
 - 2. Consolidated Kinetics Corp.
 - 3. Flex-Hose Co.
 - 4. Keflex
 - 5. Korfund Dynamics Corp.
 - 6. Mason Industries, Inc.
 - 7. Metraflex
 - 8. Peabody
 - 9. Twin City Hose, Inc.
 - 10. Vibration Eliminator Co.

2.02 GENERAL

- A. Furnish and install vibration isolating mountings to isolate from the structure, by means of resilient vibration and noise isolators, all Mechanical Equipment having rotating or reciprocating parts. Isolators shall be supplied by a single source, and shall be guaranteed by the manufacturer to provide isolation efficiencies in accordance with this specification. Selection shall be based on equipment proposed, power dissipated, frequency, weight distribution and nature of the building structure.
- B. Selection of the mountings shall be made of the manufacturer to provide a transmissibility not exceeding 10%.
- C. Vibration or noise created in any part of the building by the operation of any equipment furnished and/or installed under this Contract shall be prohibited, and this Contractor shall take all precautions by isolating the various items of equipment, pipe and sheet metal work from the building structure. The major items of equipment shall be isolated as called for on the plans and specified herein. The minor items shall be held the responsibility of this Contractor.
- D. Vibration isolators shall have either known undeflected heights or their markings so, after adjustment, when carrying their full load, the deflection under load can be verified, this determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided.
- E. Size vibration isolators to operate in the linear portion of their load versus deflection curve. Furnish load versus deflection curves (linear over a deflection range 50 percent above the design deflection).
- F. The ratio of lateral to vertical stiffness of vibration isolators shall not be less than 1.0 or greater than 2.0.
- G. The vertical natural frequency for each support point based upon the load per isolator and isolator stiffness shall not differ by more than plus or minus 10 percent.
- H. Shore hardness of neoprene mountings: 40 to 60 after minimum aging of 20 days or corresponding overaging.
- I. Design or treat all isolators for resistance to corrosion. Structural steel bases shall be cleaned of welding slag and painted with a coat of red lead primer for interior use, and hot dip galvanized after fabrication for exterior use. All nuts, bolts and washers shall be zinc electroplated for interior use and hot dip galvanized for exterior use.
- J. Select all mounts to perform their function without undue stress or overloading. All isolators that are to be used with structural steel bases shall be equipped with height saving brackets. The bottom of the brackets shall be 1-1/2 inches above the floor. Furnish isolators with a method of leveling and where spring isolators are used, provide gussets on both sides of the isolators or other structural reinforcement as required to prevent distortion.
- K. Construct all structural steel bases with a minimum of four points of support. Structural steel bases: coped and fitted or constructed using the overlap insert method. Operating clearance of steel bases: at least 1-1/2 inches above the floor or housekeeping pad, clearance not to exceed 2-1/2 inches.
- L. This Contractor shall provide concrete fill for pumps' inertia pads.

2.03 MECHANICAL EQUIPMENT ISOLATION

- A. Ceiling suspended shall be suspended by threaded rods from the overhead structure with two inch deflection spring type vibration isolators at the mounting bracket. Mounting bracket with vibration isolators shall be furnished by the equipment manufacturer.
- B. Ceiling fans shall be suspended from structure utilizing rubber type grommets on suspension hangers.
- C. Connections from pump outlet and discharge nozzles to piping shall be made with flexible connectors.

1. Isolate each base mounted pump from the piping systems by use of pipe-size neoprene or EDPM ("rubber") type flexible connector couplings constructed of multiple piles of nylon and bias-ply tire cord reinforcing fabric with Control Cable and 150 psig ANSI steel flanges.
 2. Isolate in-line pump support rods from building structure with rubber grommet type isolators. Install braided flexible pump connectors on inlet and discharge side of in-line pumps. Braided flexible pump connectors shall be constructed of stainless steel hose covered with stainless steel wire braid with NPT steel nipples or 150 psig ANSI flanges, welded to hose. Connectors shall be as manufactured by Flex-Hose Co., Metraflex or Twin City Hose, Inc.
- D. Water chillers shall be mounted on precompressed molded fiberglass or rubber-in-shear isolation pads as recommended by the manufacturer. Pads shall be placed under the unit, on the roof equipment support rails. The isolators shall provide 90% isolation efficiency.
- E. All floor supported piping and pipe hangers in the Mechanical Equipment rooms shall be mounted on steel spring vibration isolators in combination with precompressed molded fiberglass noise isolators, designed for minimum static deflections of 1".
- F. Suspended piping entering or leaving base mounted pumps shall be supported for the first three hangers, from the overhead structure. The resilient hangers shall contain steel springs and precompressed molded fiberglass inserts, designed for static deflections between 1" and 1-3/4" under operating conditions.
- G. Refrigerant piping supported from walls, hangers or structural steel shall be isolated utilizing rubber grommets.
- H. Fans shall be supported independently of casings and ductwork with flexible canvass connections. Flexible canvas duct shall comply with NFPA 90A. Flexible connector shall be factory fabricated with fabric strip attached to 2 strips of 2-3/4 inch-wide, 0.028-inch-thick, galvanized-steel sheet.
1. Flexible connector fabric shall consist of glass fabric, double coated with neoprene. Fabrics, coatings, and adhesive shall comply with UL 181, Class 1.
 - a. Favric Minimum Weight: 26oz./sq.yd.
 - b. Fabric Tensile Strength: 480 ibf/inch in the warp and 360 ibf/inch in the filling.
 - c. Fabric Service Temperature: Minus 40 to plus 200°F.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which vibration control units are to be installed.
- B. Do not proceed with work until satisfactory conditions have been corrected in manner acceptable to installer.

3.02 PERFORMANCE OF ISOLATORS

- A. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

3.03 INSTALLATION

- A. General: except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration control materials and units. Adjust to ensure that units have equal deflection, no not bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices intended for temporary support during installation.
- B. Adjust leveling devices as required to distributed loading uniformly onto isolators. Shim units as required where substrate in not level.

END OF SECTION 23 08 10

**SECTION 23 10 10
COMMON PIPING REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The other Specifications of this Division complement the requirements of this Section.
- C. For general Codes and Standards requirements refer to Section 23 00 20.

1.02 SCOPE

- A. This Section specifies piping materials and installation methods common to more than one section of Division 23 and includes fittings, joining methods, and basic piping installation instructions.
- B. Not all pipe materials and joining methods listed in this section pertain to this project. See specific system sections within this Division for approved materials and installation methods allowed to be used on this project.**
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. The installation of copper tubing in Hydronic systems shall conform to the requirements of the ICC International Mechanical Code and the Ohio Mechanical Code.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."
- C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- D. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by the same manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.
- E. All grooved couplings shall be installed strictly according to grooved manufacturer's instructions including torque verification and specific lubrication as published.
- F. All piping materials, valves, fittings, joints, etc. shall be manufactured in the United States of America.
- G. Installer Qualifications:
 - 1. Press Fitting Installers: Installers of press fitting joints shall be certified by the manufacturer as having been trained and qualified and licensed within the jurisdiction for the installation of copper press joint systems.
- H. Copper press fittings shall be installed using the proper tool, actuator, jaws and rings as instructed by the press fitting manufacturer.

1.04 CODES AND STANDARDS

- A. ASME Compliance:
 - 1. Comply with ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping" for materials, products, and installation.
- B. All welding and brazing shall be in accordance with the Ohio Administrative Code (OAC) 4101:8-15 "Welding and Brazing" and Section IX of the ASME "Boiler and Pressure Vessel Code".

- C. All pressure piping systems shall be installed in accordance with the OAC 4101:8 "Pressure Piping System Rules".
- D. All mechanical piping systems shall be installed in accordance with the Local Mechanical Code.
- E. All refrigeration systems shall be installed in accordance with the Local Mechanical Code and the Safety Code for Mechanical Refrigeration (ANSI B9.1) and ASME B31.5.
- F. All refrigeration systems shall comply with UL 207 Refrigerant Containing Components and Accessories.

PART 2 PRODUCTS

2.01 GENERAL

- A. Piping Materials
 - 1. **Refer to individual system specification sections for allowable locations for each piping material, fitting style, and joining method. The following materials and joining may not be acceptable for certain projects and in certain areas.**
 - 2. Provide pipe of type, joint type, grade, size and weight (wall thickness or class) as is indicated for each service in other Division 23 sections of this specification.
 - 3. Where type, grade or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.

2.02 PIPE FITTINGS

- A. General
 - 1. Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size.
 - 2. Provide sizes and types of matching pipe, valve or equipment connections in each case.
 - 3. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.
- B. Joining Materials
 - 1. Soldering Materials: Surfaces to be soldered shall be cleaned, properly fluxed and soldered with 95-5 tin-antimony solder. 50-50 and all other lead-bearing solders are prohibited.
 - 2. Gaskets For Flanged Joints: Select materials and types to suit the service of the piping system in which they are installed. Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.
 - 3. Gaskets For Mechanical Couplings: Select materials to suit the service of the piping system in which they are installed. Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.03 COPPER PIPE AND FITTINGS

- A. Type K Soft Copper: ASTM B 88 water tube, annealed temper
- B. Type L Hard Copper: ASTM B 88 water tube, drawn temper
- C. Type ACR Hard Drawn Seamless Copper Tube: ASTM B 819
- D. Copper, Solder-Joint Fittings:
 - 1. ASME B16.22, wrought-copper, brazed or solder-joint pressure type.
- E. Copper, Pressure-Seal Fittings:

1. Press Fittings: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkart
 - b. Nibco
 - c. Viega; Plumbing & Heating Systems (Pro-Press).
 3. NPS 2 and Smaller:
 - a. Wrought-copper fitting with EPDM O-ring seal in each end.
 4. NPS 2-1/2 to NPS 4
 - a. Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- F. Copper, Grooved-Joint:
1. Manufacturers: available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International.
 - b. Victaulic Company.
 2. Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
 3. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.04 BLACK STEEL PIPE AND FITTINGS

- A. Pipe Materials shall conform to the following standards:
1. Steel Pipe, NPS 2-1/2" and Smaller: ASTM A 53, Type S (seamless) or, Grade B, Schedule 40 or 80, black steel, plain ends, with threaded joints per ANSI B16.4.
 2. Steel Pipe, NPS 3 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.
- B. Black Steel, Threaded:
1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, seamless steel pipe. For NPS 2" and smaller and electric-resistance welded for NPS 2-1/2" and larger.
 2. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 3. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
 4. Malleable-Iron Unions: ASME B16.39; Classes 150, 250 and 300.
- C. Steel Flanges:
1. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125 and 250; raised ground face, and bolt holes spot faced.
 2. Wrought-Steel Fittings: Welding neck type, ASTM A 234/A 234M, wall thickness to match adjoining pipe.
 3. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: Welding neck type, ASME B16.5, including bolts, nuts, and gaskets.

- D. Black Steel, Welded:
 - 1. Schedule 40 Factory Formed, Conforming with ASME B16.
 - 2. Flanges: ASME B16.1, Class 125, cast iron.
- E. Black Steel, Grooved-Joint:
 - 1. Manufacturers: available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International.
 - b. Victaulic Company.
 - 2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - 3. Grooved-End, Ductile-Iron-Pipe Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.05 PVC PIPE AND FITTINGS

- A. PVC Socket Fittings: ASTM D 2665, socket type.

2.06 CPVC PIPE AND FITTINGS

- A. CPVC Pipe: ASTM F 441.
- B. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.

2.07 PEX TUBING AND FITTINGS

- A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

2.08 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Acceptable Manufacturers:
 - a. Eslon Thermoplastics.
- B. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Acceptable Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.

2.09 DIELECTRIC TRANSITION FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: **Dielectric Unions are not allowed.**
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Acceptable Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.

- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Acceptable Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Acceptable Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Acceptable Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.10 JOINING MATERIALS AND METHODS

- A. Grooved: Roll grooved joints per coupling manufacturer's specifications.
- B. Pressed: Pressed joints per manufacturer's recommendations, using tool designed and approved specifically for use with fittings.
- C. Threaded: Pipe threads shall conform to ASME B1.20.1.
- D. Welding: Comply with ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- E. Pipe-Flange Gasket Materials: Select materials and types to suit the service of the piping system in which they are installed. Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is 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.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- F. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- G. Plastic, Pipe-Flange Gasket, Bolts, and Nuts:
 - 1. Type and material recommended by piping system manufacturer, unless otherwise indicated.
- H. Solder Filler Metals:

1. Surfaces to be soldered shall be cleaned, properly fluxed and soldered with 95-5 tin-antimony solder. 50-50 and all other lead-bearing solders are prohibited.
 2. ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813. 50-50 and all other lead-bearing solders are prohibited.
- I. Brazing Filler Metals:
1. Comply with ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being jointed. Silver brazing alloy shall have a melting point above 1000° F.
 2. AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated
 3. AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- J. Welding Filler Metals:
1. Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- K. Gaskets for Mechanical Couplings:
1. Select materials to suit the service of the piping system in which they are installed. Provide materials that will not be detrimentally affected by the chemicals and thermal conditions of the fluid being carried. Gaskets for Hydronic piping shall be EHP or EPDM, suitable for -30° F to 230° F temperature range.
- L. Solvent Cements for Joining Plastic Piping:
1. ABS Piping: ASTM D 2235.
 2. CPVC Piping: ASTM F 493.
 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 4. PVC to ABS Piping Transition: ASTM D 3138.

2.11 UNIONS AND FLANGES

- A. All unions and flanges shall be suitable for the temperature/pressure ratings and service in which installed. See each specific system description section of Division 32 for additional information.

Table 23 10 10.1

Pipe Material	Size	Description
Steel	2" and smaller	Malleable iron, threaded ends, ground joint brass to iron seat
	2-1/2" and larger	Weld-neck flange connections
Copper	2" and smaller	Cast brass solder ends, with machined and lapped seats
	2-1/2" and larger	Flange connections

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris and moisture.
- B. Protect Stored Pipes: Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor or structure.
- C. Protect flanges, fittings and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

3.02 GENERAL PIPING INSTALLATION REQUIREMENTS

- A. The Drawings indicate the general location and arrangement of the piping systems. So far as practical, install piping as indicated making connections to all equipment.
- B. Install piping as direct as possible avoiding unnecessary offsets. However, if offsets are required in order to obtain maximum headroom or to avoid conflict with other work, they shall be made as required or as requested by the Architect without additional cost to the Owner. The Architect reserves the right to make minor changes in the location of piping and equipment during the roughing-in, without additional cost to the Owner. All changes proposed by others shall be approved by the Architect.
- C. Install piping, requiring insulation, a sufficient distance from wall, ceiling, structure, other pipes, etc. to permit the application of the full thickness of insulation specified.
- D. Install piping free of sags or bends.
- E. Where piping is installed above accessible ceilings, allow sufficient space between ceiling and pipe to remove ceiling panels. Consideration must be given for insulation thickness.
- F. Locate piping installed parallel to each other with adequate space for servicing of valves where applicable.
- G. Any piping resting on or coming in contact with building structure shall be insulated at that point to prevent transmission of vibration.
- H. All piping shall be installed parallel with, or at right angles to, the building walls. All vertical risers shall be installed plumb and straight. Diagonal runs are not permitted unless expressly indicated on the drawings.
- I. Install all piping with reduction in size being made only at the inlet and outlet of control valves, regulating valves and equipment.
- J. Make reductions in piping with a reducing coupling or weld fitting reducer. Bushings are not permitted.
- K. Factory formed long radius elbows shall be utilized for all changes in direction. Mitering of pipe to form elbows is not permitted. Pipe bending is not acceptable.
- L. Make branch connections in threaded or soldered piping with factory formed fittings.
- M. Make branch connections in welded steel piping less than 2/3 of main size with weldolets or threadolets. Make branch connections 2/3 of main size or larger with weld tees. Notching of straight runs of pipe to form tee connections is not permitted.
- N. Taps shall be provided as necessary to permit the installation of control devices, thermometers, pressure gauges, air vents, etc. Taps shall be similar to branch connections.
- O. Pipe relief valve discharges, etc. down to the floor or nearest floor drain where indicated. Drain piping shall terminate with a plain, unthreaded end.
- P. Install dielectric waterway fittings wherever pipe of different metal is connected. Dielectric unions are not permitted. Brass valves shall not be utilized for dielectric separation.
- Q. Bullhead connections in any piping system are prohibited.
- R. Schedule 80 PVC installation shall comply with the latest installation instructions published by pipe manufacturer and shall conform to all local code requirements. Solvent cement joints shall be made in a two step process with primer manufactured for thermoplastic piping systems and solvent cement conforming to ASTM D 2564.

3.03 HANGING AND SUPPORT

- A. Support piping independently so as not to place a strain on valves and equipment.
- B. See Section 23 12 20 - Piping Hangers and Supports for more details.

3.04 JOINTS

- A. After cutting, ream ends of piping and remove all burrs. Remove all scale, slag dirt and debris from both inside and outside of piping and fittings before assembly. Swab if necessary for thorough cleaning.
- B. Pipe to be threaded shall be cut square and fully threaded with tapering threads. Apply pipe joint compound to male thread end of all threaded joints. Joint compound shall be compatible with the service of the piping.
- C. The edges of pipe to be welded shall be machine beveled wherever possible. Before welding, the surfaces shall be thoroughly cleaned. The piping shall be carefully aligned. No metal shall project within the pipe.

3.05 EXPANSION

- A. Piping shall be cut accurately to measurement at the site and worked into place without springing or forcing. Sufficient offsets, expansion loops or expansion joints between anchor points shall be provided as required, whether or not shown, to limit stresses and control movement of piping subject to the thermal expansion.
- B. Supplement all loops, joints, compensators, etc. with adequate guides to preserve alignment and pitch.
- C. Securely attach pipe guides to the building structure.
- D. Anchor piping to ensure proper direction of expansion and contraction. Provide expansion loops or joints as indicated or as required to control expansion and contraction.
- E. See Section 23 18 20 for additional requirements.

3.06 ESCUTCHEONS

- A. Fit all pipe passing exposed to view through walls, floors or ceilings in finished rooms with brass escutcheons. Where adjacent surface is to receive a paint finish, prime paint escutcheons, otherwise escutcheons shall be chrome plated. Where piping is insulated, fit escutcheons outside insulation. Pipes penetrating mechanical room walls do not require escutcheons.

3.07 CLEANING

- A. After piping installation is complete and before final connections to equipment are made, thoroughly flush the piping system with a material/detergent that is not injurious to the pipe, to remove all pipe dope, oils, welding slag, scale and other extraneous material.
- B. After flushing, clean all strainers, traps and dirt legs.
- C. See each specific system description section of Division 23 for additional cleaning requirements.

END OF SECTION 23 10 10

**SECTION 23 10 20
HYDRONIC PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The other Specifications of this Division complement the requirements of this Section.
- C. Refer to Section 23 10 10 for Common Piping Requirements.

1.02 SCOPE

- A. This Section specifies piping materials and installation methods for hydronic system piping and includes fittings, joining methods and specific piping installation instructions.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. See drawings and each specific system description indicated herein for specific sizes, materials and installation methods pertaining to this project. Portions of this Section may not be required for this project.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Sections 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 GENERAL

- A. All piping shall be constructed of materials and joined together as specified in the following sections.
- B. Material specifications are contained in Section 23 10 10 - Common Piping Requirements.

2.02 PIPE AND FITTING TABLE

- A. The table below identifies the acceptable pipe materials, fitting types, and joint methods allowed for each pipe service and size.
- B. Pipe schedules refer to ANSI B36.
- C. Pipe sizes refer to Nominal Pipe Sizing (NPS) standards.
- D. Where more than one pipe material, fitting type, or joint method is indicated for the same system type; it shall be the installing contractor's choice to determine which type shall be utilized.

Editor's Note: Copper = Press Fittings Allowed? Coordinate with Owner
Editor's Note: Grooved Allowed for Hydronic Piping? Coordinate with Owner

Table 23 10 20.1

Service	Size	Pipe Material	Fittings	Joint Method*
Coil Condensate Drain	All Sizes	Type L Copper	Wrought Copper	S
				P
		Schedule 40 PVC	Factory Formed schedule 40 PVC	C
Heating Water	2" and smaller	Schedule 40 Black Steel	125 lb. cast iron	T

		Type L Hard Copper	Wrought copper	S
		Type L Hard Copper	Wrought copper	P
	2-1/2" to 10"	Schedule 40 Black Steel, ASTM A53, Type E, Grade A	Schedule 40 Factory Formed	W
	2-1/2" to 10"	Schedule 40 Black Steel, ASTM A53, Type E, Grade A	Schedule 40 Factory Formed with factory grooved ends	G
Chilled Water	2" and smaller	Schedule 40 Black Steel	125 lb. cast iron	T
		Type L Hard Copper	Wrought copper	S
	2-1/2" to 10"	Schedule 40 Black Steel, ASTM A53, Type E, Grade A	Schedule 40 Factory Formed	W
	2-1/2" to 10"	Schedule 40 Black Steel, ASTM A53, Type E, Grade A	Schedule 40 Factory Formed with factory grooved ends	G
*Joint Methods: B=Brazed, C=Solvent Cement, G=Grooved, P=Pressed, S=Soldered, T=Threaded, W=Welded				

PART 3 EXECUTION

3.01 INSTALLATION

- A. All hydronic piping systems must be installed so it can be completely drained. Provide tee fitting, ball valve with hose thread fitting and cap at all low points, trapped sections, bases of risers, and on equipment side of shut off valves to permit draining. Provide ball valves at all high points to allow venting. All drain valves and vents shall be accessible. All air vent valves shall have a 3/8" soft copper discharge tube elbowed downward, away from pipe and pipe insulation.
- B. Make branch connections to mains for heating risers and heating equipment with at least two (2) 90 degree elbows.
- C. Installation shall conform to Section 23 10 10 - Common Piping Requirements.

3.02 CLEANING AND TESTING

- A. Comply with requirements in Section 23 03 10.

END OF SECTION 23 10 20

**SECTION 23 10 40
REFRIGERANT PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The other Specifications of this Division complement the requirements of this Section.
- C. Refer to 23 10 10 for Common Piping Requirements.

1.02 SCOPE

- A. This Section specifies piping materials and installation methods for refrigerant piping systems. See drawings and each specific system description indicated herein for specific sizes, materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Sections 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 GENERAL

- A. All piping shall be constructed of materials and joined together as specified in the following sections.
- B. Material specifications are contained in Section 23 10 10.

2.02 PIPE AND FITTING TABLE

- A. The table below identifies the acceptable pipe materials, fitting types, and joint methods allowed for each pipe service and size. Where multiple options are listed, the option used shall be at the discretion of the Contractor.

Editor's Note: Packaged refrigerant tubing (line sets) is available 3/8" thru 1-1/8" sizes and maximum 100 foot length (50 feet is more typical). Tubing is factory cleaned and capped but does not contain a holding charge.

Do not allow line-sets where piping is visible to public view. Allow only for mini-splits and VRF runouts from manifolds/zone boxes to individual indoor units.

Table 23 10 40.1

Service	Size	Pipe Material	Fittings	Joint Method*
Refrigerant Liquid	All Sizes	Type L- ACR Hard Drawn Seamless Copper Tube	Wrought Copper	B
Refrigerant Liquid	1-5/8" and smaller	Type L Soft Annealed Copper Line Set	Flared	M
Refrigerant Suction	All Sizes	Type L-ACR Hard Drawn Seamless Copper Tube	Wrought Copper	B
Refrigerant Suction	1-5/8" and smaller	Type L Soft Annealed Copper Line Set	Flared	M

*Joint Methods: B=Brazed, M=Mechanical

- B. All ACR tubing and line sets shall be shipped with a sealed holding charge of nitrogen.

2.03 REFRIGERANT SPECIALTIES

- A. Filter-Drier: Steel shell, steel flange ring, steel spring, ductile iron cover plate with steel capscrews, wrought copper solder ends, 500 psig operating pressure. Furnish complete with replaceable filter-drier core kit, including gaskets and standard capacity desiccant sieves to provide micronic filtration.
- B. Sight Glass: Forged brass body, replaceable polished optical viewing window, solder ends, 500 psig operating pressure, and 200 °F operating temperature.
- C. Flexible Connectors: Seamless tin bronze or stainless steel core, high tensile bronze braid covering with synthetic covering, factory pressure tested, minimum 7 inch length, solder ends, 500 psig operating pressure.

2.04 REFRIGERANT

- A. Refrigerant in accordance with ASHRAE Standards – see equipment schedules for required refrigerants.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide filter/drier assemblies, moisture indicators, thermal expansion valve and solenoid valves for each refrigeration circuit.
- B. Piping and specialties shall be sized to prevent excessive pressure drop and allow compressors and evaporators to operate together with balance points at or above the specified capacities.
- C. Piping and specialties shall be arranged to return oil at all loads and prevent liquid from "slugging" the compressor or siphoning to the evaporator. Provide double suction risers and traps as required.
- D. Refrigerant piping shall be cut with a tube cutter only and shall be reamed after cutting. Hack saw cuts are prohibited.
- E. Pitch horizontal refrigerant piping 1/2 inch per 10 feet in direction of flow.
- F. Provide separate refrigerant circuits for multiple compressor applications.
- G. All refrigerant piping shall be assembled with brazed joints. Continuously purge joints while being brazed with oil-free dry nitrogen to prevent the formation of scale within the tubing. Copper to copper refrigerant piping joints shall be made using a phosphorus bearing alloy such as "Sil-Phos" without flux. Copper to brass and copper to steel joints shall be made using a 45% silver alloy such as "Easy-Flo" with flux.
- H. Install strainers immediately ahead of each thermostatic expansion valve, solenoid valve and as required to protect refrigeration piping system components.
- I. Install unions to allow removal of thermostatic expansion valves and solenoid valves and at connections to compressors and evaporators.
- J. Install flexible connectors at the inlet and discharge connections of compressors.
- K. Install pressure regulating and relieving valves as required by ASHRAE Standard 15 and the Safety Code for Mechanical Refrigeration (ANSI B9.1).
- L. Refrigerant system piping layout and sizing shall be approved by the equipment manufacturer and engineer.
- M. Packaged soft refrigerant piping systems may be utilized for individual refrigeration systems of five ton capacity or smaller. Packaged refrigerant piping systems shall be cleaned and sealed. Packaged piping systems shall remain sealed until immediately before installation.

3.02 TESTING

A. Test refrigerant piping with oil-free pumped dry nitrogen. Twenty four hour standing time minimum. Tests shall conform to "Pressure Piping Code" 4101:8-3 and ANSI Standard B31.5 "Refrigerant Piping".

B. Refer to the table below for required test pressures:

Table 23 10 40.2

Type	Line Type	Pressure (psig)
R-134a	Suction Lines for Air-Conditioning Applications	115
	Suction Lines for Heat-Pump Applications	225
	Hot-Gas and Liquid Lines	225
R-407C	Suction Lines for Air-Conditioning Applications	230
	Suction Lines for Heat-Pump Applications	380
	Hot-Gas and Liquid Lines	380
R-410A	Suction Lines for Air-Conditioning Applications	300
	Suction Lines for Heat-Pump Applications	535
	Hot-Gas and Liquid Lines	535
General Notes: 1. Test piping with oil-free pumped dry nitrogen 2. Test duration shall be 24 hours. 3. Test Per Pressure Piping Code 4101:8-3 and ANSI Standard B31.5		

C. After the test pressure has been applied for the required time period, examine the system for leakage. All joints must then be thoroughly leak tested using either an electronic leak detector, a halide torch or soap bubbles. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat tests until there are no leaks.

3.03 CHARGING

A. After the refrigerant piping has been leak checked, the entire piping system shall be evacuated using the triple evacuation method or an appropriate method as recommended by the equipment manufacturer. Piping shall be drawn successively to 1,500 microns, 1,500 microns and 500 microns of vacuum. The vacuum should be broken each time using system refrigerant. After evacuation, the system shall be charged with the proper amount of refrigerant for designed operation.

END OF SECTION 23 10 40

**SECTION 23 11 10
PIPING INSULATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping insulation materials and installation methods common to more than one section of Division 23.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all insulation work described in this Section.

1.03 CODES AND STANDARDS

- A. Provide all insulation materials (insulation, jackets, fitting covers, adhesives, cements, mastics, sealers and finishes) with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

1.04 QUALITY ASSURANCE

- A. Installing contractor shall have at least 3 years successful installation experience on projects with mechanical insulation similar to that required for this project.
- B. Insulation thickness shall meet the requirements of ASHRAE Standard 90.1.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Sections 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Unless otherwise noted, and subject to compliance with Specifications, provide insulation materials from the manufacturers specified below:
 - 1. Fiberglass Pipe Insulation
 - a. CertainTeed Corp.
 - b. Johns Manville
 - c. Knauf Insulation
 - d. Owens Corning
 - 2. Closed Cell Elastomeric Pipe Insulation
 - a. Armaflex
 - b. Aeroflex
 - c. Insul-Tube
 - d. K-Flex USA
 - e. Manson Insulation
 - f. Nomaco Kflex
 - g. Techlite Insulation

h. Thermacel

2.02 GENERAL

- A. Provide all insulation materials (insulation, jackets, fitting covers, adhesives, cements, mastics, sealers and finishes) with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

2.03 FIBERGLASS

- A. Provide one-piece fiberglass pipe insulation with all-service jacket for all piping systems indicated on drawings or in other sections of this Specification.
- B. Fiberglass pipe insulation shall have a "k" factor of 0.23 at a mean temperature of 75 °F.
- C. Fiberglass pipe insulation shall comply with ASTM C 547 Type I.
- D. Factory applied all service jacket shall be white, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
- E. Provide fiberglass pipe insulation in accordance with the following:

Table 23 11 10.1

Pipe Type	0 to 1"	1-1/4" to 2"	2-1/2" to 4"	5" and 6"	8" and above
Indoor Chilled Water Piping (40°F and above)	1"	1"	1"	1"	1"
Outdoor Chilled Water Piping	2"	2"	2"	2"	2"
Cooling Coil Condensate Drain Piping (not in units)	1/2"	1"	1"	1"	1"
Heating Hot Water Piping	1"	1-1/2"	1-1/2"	1-1/2"	1-1/2"
Make-up Water Piping	1"	1"	1"	1"	1"

2.04 CLOSED CELL ELASTOMERIC INSULATION

- A. Provide closed-cell elastomeric pipe insulation for all piping systems indicated on drawings or in other sections of this Specification.
- B. Closed cell elastomeric pipe insulation shall comply with ASTM C 534 Type I.
- C. Apply the following insulation thickness schedule to the pipe size and type:

Table 23 11 10.2

Pipe Type	0 to 1"	1-1/4" to 2"	2-1/2" to 4"	5" and 6"	8" and above
Air Conditioning Condensate Drain Piping (within unit cabinet)	1/2"	1"	1"	-	-
Refrigerant Suction & Hot Gas Piping	1/2"	1"	1"	1"	1-1/2"
Refrigerant Liquid Piping (Ductless, VRF and Heat Pump systems)	1/2"	1"	1"	1"	1-1/2"

2.05 PVC JACKETS

- A. PVC jacket shall be high-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C.

2.06 ALUMINUM JACKETS

- A. Jacket shall be 0.016" thick sheet aluminum.

2.07 OUTDOOR PIPING WATERPROOF MEMBRANE

- A. Waterproofing membrane shall consist of sheet-type, pre-fabricated, self-adhering, UV-resistant products. Waterproof membrane shall be as manufactured by MFM Building Products Corp., (Flexclad 400) or by Venture Tape Corp. (VenttrueClad 1577).

2.08 ADHESIVES

- A. Adhesive shall have UL classification and be non-flammable.
- B. Adhesives for Fiberglass: MIL-A-3316C, Classes 1 and 2, Grade A.
- C. Adhesives for Elastomerics: MIL-A-24179A, Type II, Class 1.

PART 3 EXECUTION

3.01 INSTALLATION

- A. On exposed piping, locate insulation and cover seams in least visible locations.
- B. Install piping insulation continuous through all wall, floor and ceiling penetrations, sleeves and pipe hanger locations.
- C. Install fiberglass pipe insulation with joints butted firmly together. Seal jacket laps with butt strips, having factory applied adhesives. **Insulate valves and fittings using mitered sections of insulation or premolded fitting insulation.** Cover valves and fittings with the same type and density of insulation as used on the piping. Do not cover valve bonnets, unions and strainers with insulation except for chilled water and domestic cold water piping systems.
- D. Taper all insulation ends, seal and cover with glass cloth regardless of service. Where vapor barrier jackets are used on cold surfaces, apply insulation with vapor seal integrity maintained throughout the entire system. Staples shall not be used on any cold piping systems.
- E. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping, apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.
- F. Apply the manufacturer's recommended adhesive for closed-cell elastomeric pipe and sheet insulation based on the working temperature of service.
- G. Insulate all valves and fittings to match adjacent piping.

3.02 JACKET LOCATIONS

- A. Interior:
 - 1. All interior piping fittings shall have molded PVC fitting covers.
 - 2. All piping that is installed exposed to view in habitable spaces shall receive a PVC jacket up to above the space's ceiling. In spaces with no ceiling, install up to 8 feet above floor.
 - 3. Provide aluminum on interior pipe risers exposed to view in habitable spaces up to 8 feet above floor.
 - 4. Provide PVC jacket on all piping in kitchen areas that are exposed to view.
- B. Exterior – Closed Cell Elastomeric Insulation:
 - 1. Install UV resistant PVC jackets on all exterior piping with weatherproof membrane (refer to part 2). The entire assembly shall be weatherproof and installed per manufacturer's recommendations.
- C. Exterior – Fiberglass Insulation:
 - 1. Cover with an aluminum jacket in addition to the normal finish, unless noted otherwise on the drawings.
 - 2. A two-inch lap is required at all longitudinal and circumferential joints.
 - 3. Longitudinal joints shall be located at the 3 or 9 o'clock position on the side of horizontal piping with 2" overlap facing down to shed water.

4. Bands shall be 3/4" wide aluminum installed 18" on-center. The entire assembly shall be weatherproof.

3.03 DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.
- C. Replace damaged insulation which cannot be satisfactorily repaired, including insulating with vapor barrier damage and moisture-saturated insulation.
- D. The insulation installer shall advise the Architect, Construction Manager and General Contractor as to requirements for protection of the insulation work during the remainder of the construction period (after the installation of insulation), to avoid damage and deterioration of the finished insulation work.

END OF SECTION 23 11 10

**SECTION 23 12 10
PIPING IDENTIFICATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping identification and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All pipe markers shall conform to ANSI A13.1 "Scheme for the Identification of Piping Systems".

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Sections 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Schedules: Submit valve schedule for each piping system. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space) and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses by special "flags" in margin if schedule. After review and approval of valve schedule, furnish extra laminated copies for Maintenance Manuals as specified in Division 1. Valve numbering sequence shall follow the format of the Owner's existing system.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide identification as manufactured by one of the following:
 - 1. Brady Corp.
 - 2. Brimar Industries, Inc.
 - 3. Craftmark Identification Systems.
 - 4. DuraLabel/Graphic Products
 - 5. Identification Depot
 - 6. Kolbi Pipe Marker Co.
 - 7. Marking Services, Inc.
 - 8. Seton Identification Products.

2.02 PIPE MARKERS

- A. Colored, precoiled plastic, designed to install without the need for tape or a band. Markers to include flow direction arrows and lettering describing pipe's contents. Markers shall provide 360° visibility.

- B. Markers for installation on piping with outside diameter less than 6" (including insulation) shall be snap-around type. Markers for installation on piping with outside diameter 6" or greater (including insulation) shall be strap-around type.
- C. Marker colors shall be based on hazard levels of material contained in piping. Note – medical gas markers do not conform to this requirement.

Table 23 12 10.1

Hazard Type	Color Scheme
High Hazard	Yellow with black letters
Low Hazard Gas	Blue with white letters
Low Hazard Liquid	Green with white letters

- D. Marker colors and wording for each specific piping system shall be as follows:

Table 23 12 10.2

Marker Wording	Background/Lettering
Chilled Water Return	Green/White
Chilled Water Supply	Green/White
Heating Water Return	Yellow/Black
Heating Water Supply	Yellow/Black
Makeup Water	Green/White
Refrigerant Piping*	Yellow/Black
* indicate liquid, suction, or hot gas	

2.03 VALVE TAGS

- A. Brass valve tags, 1-1/2" diameter round with black fill letters and numbers. 19 gauge brass with 3/16" top hole.
- B. Valve tags shall have a 1/4" high "HVAC" label.
- C. Each system shall be consecutively numbered, starting with "1", with 1/2" high numbers.
- D. Valve tags shall be attached to each valve with a non-rusting ring or chain.
- E. Valve Location Tags: 3/4" diameter colored, pressure-sensitive adhesive paper circles.

2.04 CEILING MARKERS

- A. Ceiling markers shall be provided for mechanical devices concealed above ceilings, including all shut off valves.
- B. Ceiling markers shall be 1" diameter white sticky tags with 1/4" black lettering.
- C. Markers for valves shall match the valve tag schedule with the system abbreviation.
- D. Ceiling markers shall be worded as follows:
 1. Valves – HWS-xxx, where "HWS" is the abbreviated piping system – heating water supply, and xxx is the number from the valve tag schedule.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated in coordination with the Owner or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

3.03 PIPE MARKER INSTALLATION

- A. Install pipe markers at the following locations:
 1. Adjacent to valves.
 2. Where pipes pass through walls, on both sides of wall.
 3. Where pipes pass through floor, above floor, within two feet of floor level.
 4. Near all branches and changes in direction.
 5. At 20 foot intervals on straight runs of pipe.
 6. At access door locations.

3.04 VALVE TAG INSTALLATION

- A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude valves within factory-fabricated equipment units and similar rough-in connections of end-use individual terminal units. Branch line shut off valves that serve less than five (5) terminal units, need not be tagged. List each tagged valve in valve schedule for each piping system.
- B. All shut-off and balancing valves shall be tagged except local valves adjacent to an equipment item. (Exclude valves that serve individual terminal units).
- C. At the completion of the project, provide a valve directory for each system. Include a copy of each directory in the Operating and Maintenance Manual. Coordinate the valve designation/numbering system with the Owner. Directory shall include valve designation/number, service, building location, size and equipment/fixtures controlled.
- D. Accurately record valve tag numbers and locations on the "Record Drawings".

3.05 VALVE CHARTS

- A. Valve charts shall include the following items:
 1. Valve identification
 2. Location
 3. Purpose

3.06 CEILING MARKERS INSTALLATION

- A. Ceiling markers shall be located in close proximity to the device it tags. Ceiling markers shall be installed on the tee bars of layin ceilings, but not on the main runs.

END OF SECTION 23 12 10

**SECTION 23 12 20
PIPING HANGERS AND SUPPORTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping hanging and supporting methods common to more than one section of Division 23 and includes hangers, supports, saddles, shields, clamps, inserts, and miscellaneous materials necessary for the proper hanging and supporting of piping systems. Portions of this Section may not be required in this project. See drawings and each specific system description section of Division 23 for specific sizes; materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All mechanical system piping shall be supported in accordance with the Local Mechanical Code.
- B. Hangers and supports shall comply with ANSI/Manufacturer's Standardization Society (MSS) SP-58, SP-69 and SP-89. Terminology used in this section is defined in MSS SP-90.

1.04 QUALITY ASSURANCE

- A. Qualifying welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code – Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Qualify welding processes and welding operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with these specifications, pipe hanger and support systems shall be as manufactured by one of the following:
 - 1. ANVIL
 - 2. ELCEN
 - 3. ERICO, Inc.
 - 4. Fee and Mason
 - 5. Grinnell
 - 6. Hydra-Zorb Company
 - 7. MetraFlex

- 8. PHD Manufacturing Inc.
- 9. Pipe Shields

2.02 PIPE HANGERS AND SUPPORTS

- A. All hangers, brackets, clamps, etc., shall be of standard weight galvanized steel. Perforated strap hangers shall not be used in any work. **Each hanger is to be sized to include pipe insulation.**
- B. All model numbers referenced within this specification are as manufactured by Erico.
- C. When two or more pipes are run parallel, they may be supported on Unistrut type trapeze hangers. Insulation on insulated pipe shall be continuous at trapeze hangers. At each trapeze hanger provide a minimum 12" long insulation protection shield, Model 126 or 127 with 180° calcium silicate or hardwood shield insert; thickness shall match thickness of insulation.
- D. In general, support individual horizontal piping as follows:

Table 23 12 20.1

Pipe Description	Pipe Size	Hanger Description
Uninsulated steel and plastic piping	2" and smaller	Model 100 heavy duty galvanized steel swivel loop hanger
	2-1/2" and larger	Model 400 carbon steel clevis hanger.
Uninsulated copper piping	2" and smaller	Model 101 copper plated steel swivel loop hanger
	2-1/2" and larger	Model 402 copper plated steel clevis hanger
Insulated piping (hot or cold)	2" and smaller	Model 403 or 4031 carbon steel clevis hanger for insulated pipe with insulation protection shield. Install with 180° calcium silicate shield insert (thickness to match adjacent pipe insulation). Insulation vapor barrier to be continuous at each hanger
Insulated hot piping	2-1/2" and larger	Model 610 steel one rod roller hanger with carbon steel pipe insulation protection saddle. Saddle size shall match adjacent piping insulation thickness.
Insulated cold piping	2-1/2" and larger	Model 403 carbon steel clevis hanger for insulated pipe with insulation protection shield spot welded in place. Install with 180° hard block calcium silicate insert with foil faced back (thickness to match adjacent pipe insulation). Insulation vapor barrier to be continuous at each hanger.

- E. Support all pipe hangers from all-thread rod with additional lock nut. All-thread rod size shall match hanger attachment size. Attach all hangers to the structure with concrete inserts, "C" clamps with retainer straps, beam clamps, or ceiling flanges.
 - 1. Hangers and supports anchored to poured concrete: Use malleable iron or steel concrete inserts attached to concrete forms.
 - 2. Hangers or supports anchored to precast concrete: Use self-drilling expansion shields. Expansion shields may also be used where concrete inserts have been missed or additional support is required in poured concrete.
 - 3. Attach all-thread rod 5/8" or smaller to steel with malleable iron beam clamps with carbon steel retainer strap.
 - 4. Attach all-thread rod 3/4" or larger to steel with carbon steel center-load beam clamps with forged steel eye nut.

5. Attach all-thread rod to ceiling with malleable iron ceiling flanges, anchored to structural member above ceiling.
 6. All adhesive hangers shall be approved for use with cracked concrete per the American Concrete Institute and ICC-ES standard AC308. All mechanical hangers shall be approved for use with cracked concrete per the American Concrete Institute and ICC-ES standard AC193.
- F. Where piping is supported from below, support on carbon steel pipe saddle supports. Where piping is insulated, furnish with protection shields, insulation inserts and protection saddles similar to those used with pipe hangers. Support 2-1/2" or larger hot piping on roller supports.
 - G. In supporting cold piping systems, hanger installation shall permit the installation of a continuous insulation vapor barrier.
 - H. All insulated vertical or horizontal piping supported from walls shall have continuous insulation at all support clamps. At each support clamp provide a 360 degree thermoplastic elastomer cushion insert or calcium silicate shield insert; thickness shall match thickness of insulation. Provide continuous vapor barrier.
 - I. All non-insulated vertical or horizontal piping supported from walls shall have a 360 degree thermoplastic elastomer cushion insert at each support clamp.

2.03 VERTICAL PIPE FRICTION CLAMPS

- A. In general support all vertical piping with friction type riser clamps - Model 450 or 451 for uninsulated pipes or Model 452 for insulated pipes.
 1. Steel or cast iron piping – carbon steel.
 2. Copper piping – copper plated carbon steel.

2.04 MANUFACTURED UNITS

- A. Hangers and support components shall be factory fabricated of materials, design and manufacturer complying with MSS SP-58.
 1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
- B. Thermal Hanger Shield Inserts: 100 psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover a 180 degree circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide all hangers, supports and clamps to properly support and retain piping, to control expansion, contraction and drainage and to prevent sway and vibration.
- B. Examine areas and conditions where the hangers, supports, clamps and inserts are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Proceed only after the required building structural work has been completed in the area where the piping is to be installed.
- C. The use of explosive force hammer actuated, booster assist or similar anchoring device is not permitted without prior approval from the Engineer.
- D. Provide all supplementary angles, channels, rails and plates required for support of piping. Attach to building structural members by welding, bolting or anchoring. Ceiling flanges shall be secured to the structural member above ceiling - anchoring ceiling flanges to drywall "only" is not acceptable.

- E. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze hangers. Construct of a channel or unistrut with adjustable all-thread rods. Hanger spacing shall be determined by the smallest pipe supported. Provide all insulation protection shields, insulation inserts and protection saddles similar to those used with individual hangers. In supporting cold piping systems, trapeze hanger installation shall permit the installation of a continuous insulation vapor barrier.
- F. Install hangers and supports to allow for controlled movement of the piping system, to permit movement between pipe anchors and to facilitate the action of expansion joints and bends.
- G. Install hangers and supports to provide indicated pipe slopes.
- H. Support all fire protection piping independently of other piping, per NFPA requirements.
- I. Do not support piping from another pipe or from ductwork or equipment. Do not support ceiling framing or lighting from piping.
- J. Adjust hangers and supports to equally distribute the load between all supporting members.
- K. Support all vertical copper piping with riser clamps at intervals not over 10 feet. Support all vertical steel piping at intervals not over 15 feet.
- L. Support all piping independently from equipment and isolate to prevent transmission of vibration of equipment to piping. No piping is to impose a load upon the equipment to which it is connected.
- M. If any fire proofing materials are disturbed while attaching piping hangers and supports, patch/repair those areas with the same fire proofing materials and of the same thickness as adjacent areas.

END OF SECTION 23 12 20

**SECTION 23 12 30
THERMOMETERS AND GAUGES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Specifications of this Division complement the requirements of this Section.

1.02 SCOPE

- A. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 SUMMARY

- A. This Section specifies thermometers and gauges common to more than one section of Division 23 and includes materials, specialties, and basic installation instructions. Portions of this Section may not be required in this project. See drawings and each specific system description section of Division 23 for specific sizes; materials and installation methods pertaining to this project.

1.04 CODES AND STANDARDS

- A. UL Compliance: Comply with applicable UL standards pertaining to thermometers and gauges.
- B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of thermometers and gauges.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide thermometers and pressure gauges as manufactured by one of the following:
 - 1. Weiss Instruments, Inc.
 - 2. Terice Co.
 - 3. Marshalltown Instruments, Inc.

2.02 THERMOMETERS - INTERIOR

- A. Casing:
 - 1. Die cast aluminum case and adjustable joint with baked enamel finish, 9" long, with spring secured heavy glass front and locking device capable of 180° vertical and 360° horizontal adjustment.
- B. Instrument
 - 1. Non-toxic safety liquid filled-magnifying lens, reading tube, silicone shock mounted.
 - 2. Satin faced non-reflective aluminum scale with permanently etched markings.
 - 3. Instrument shall be accurate to within 1% of scale range
 - 4. Fill with red or blue liquid

- C. Stem
 - 1. Copper-plated steel stem, separable socket well, length to suit installation. Suitable for the service of the piping system where installed.
- D. Pipe Wells
 - 1. Wells shall be brass in copper pipe and stainless steel in steel pipe, pressure rated to match piping system design pressure. Where piping is to be insulated, provide with extension.
- E. Scale
 - 1. Provide temperature ranges as follows:

Table 23 12 30.1

Service	Range	Scale Graduations
Heating Water	30-240°F	2°F
Chilled Water	0-120°F	1°F
Glycol Chilled Water	0-120°F	1°F

2.03 PRESSURE GAUGES - INTERIOR

- A. Conform to ANSI B40.1 grade 1A, with accuracy of plus or minus 1%.
- B. Phosphor bronze bourdon-tube and brass socket for 1/4" NPT bottom connection.
- C. 4-1/2" diameter steel case with clear acrylic plastic lense.
- D. Aluminum dial with white background and permanently etched black markings.
- E. Aluminum pointer with black finish.
- F. Provide gauges with 1/4" NPT brass bushing snubbers with corrosion resistant porous metal disc suitable for the service and pressure rating of the piping system where installed. Between gauge and tee in piping system, provide 1/4" bronze body, threaded ball valve suitable for the service and pressure rating of the piping system where installed.
- G. Where pressure gauge is installed in a steam system provide 1/4" NPT straight type brass steam gauge syphon.
- H. Range: Conform to the following:

Table 23 12 30.2

Service	Range	Figure Interval	Minor Graduation
Heating Water	0-60 psig	5 psig	1.0 psig
Chilled Water	0-60 psig	5 psig	1.0 psig
Glycol Chilled Water	0-60 psig	5 psig	1.0 psig
Make-up Water	0-60 psig	5 psig	1.0 psig
Low Pressure Steam	0-15 psig	1 psig	0.2 psig
Medium Pressure Steam	0-100 psig	10 psig	1.0 psig
High Pressure Steam	0-160 psig	20 psig	2.0 psig

2.04 THERMOMETERS - EXTERIOR

- A. Casing
 - 1. Die cast aluminum case and adjustable joint with baked enamel finish, 9" long, with spring secured heavy glass front and locking device capable of 180° vertical and 360° horizontal adjustment.

- B. Instrument
 - 1. Non-toxic red safety liquid filled-magnifying lens, red reading tube, silicone shock mounted.
 - 2. Satin faced non-reflective aluminum scale with permanently etched markings.
 - 3. Fill with red or blue liquid
 - 4. Instrument shall be accurate to within 1% of full scale
- C. Stem
 - 1. Copper-plated steel stem, separable socket well, length to suit installation. Suitable for the service of the piping system where installed.
- D. Thermowell
 - 1. Thermometer wells shall be brass in copper pipe and stainless steel in steel pipe, pressure rated to match piping system design pressure. Where piping is to be insulated, provide with extension.
- E. Scale
 - 1. Provide temperature ranges as follows:

Table 23 12 30.3

Service	Range	Scale Graduations	Minor Graduations
Glycol Chilled Water	-20-120°F	20°F	2°F

2.05 PRESSURE GAUGES - EXTERIOR

- A. Conform to ANSI B40.1 grade A, with accuracy of plus or minus 0.5%.
- B. Phosphor bronze C tube and brass socket for 1/4" NPT bottom connection.
- C. 4-1/2" diameter steel case with clear acrylic plastic lense.
- D. Aluminum dial with white background and permanently etched black markings.
- E. Aluminum pointer with black finish.
- F. Provide gauges with 1/4" NPT brass bushing snubbers with corrosion resistant porous metal disc suitable for the service and pressure rating of the piping system where installed. Between gauge and tee in piping system, provide 1/4" bronze body, threaded ball valve suitable for the service and pressure rating of the piping system where installed.
- G. Gauge shall be rated for exterior use, and for the ambient temperature extremes it will be subjected to for the environment it is to be located in.
- H. Range: Conform to the following:

Table 23 12 30.4

Service	Range	Figure Interval	Minor Graduation
Glycol Chilled Water	0-60 psig	5 psig	0.5 psig

PART 3 EXECUTION

3.01 THERMOMETERS INSTALLATION

- A. Install thermometers in vertical or tilted positions to allow reading by observer standing on the floor. Install thermometer wells in the vertical position. Fill well with oil or graphite and secure cap. Adjust faces to proper angle for best visibility.
- B. Install thermometers in the following locations and elsewhere as indicated
 - 1. At inlet and outlet of each air handling unit hydronic coil. Utilize interior thermometers.
 - 2. At inlet and outlet of chiller (evaporator). Utilize exterior thermometers.

3. At inlet and outlet of boilers and heat exchangers.

3.02 PRESSURE GAUGES INSTALLATION

- A. Install pressure gauges located in the piping at the most readable location for an observer standing on the floor. Install with shut off valve and snubber. For steam systems install with gauge siphon, Pressure gauges shall be installed as close as possible to the equipment or apparatus to indicate pressure changes across equipment or apparatus only. Adjust faces to proper angle for best visibility.
- B. Install pressure gauges in the following locations and elsewhere as indicated.
 1. At suction and discharge of each pump. Provide one pressure gauge with 2 independent ball valves piped to the suction and discharge piping of all pumps. Utilize interior pressure gauges
 2. At inlet and outlet of each make-up water pressure reducing valve. Utilize interior pressure gauges.
 3. At inlet and outlet of each chiller, both condenser and evaporator. Utilize exterior pressure gauges.
 4. At inlet and outlet of each air handling unit hydronic coil. Utilize interior pressure gauges.
 5. At outlet piping of each boiler (unless integral to the boiler).

3.03 ADJUSTING AND CLEANING

- A. Adjusting: Adjust faces of thermometers and gauges to proper angle for best visibility.
- B. Cleaning: Clean windows of thermometers and gauges and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.
- C. Connections: Piping installation requirements are specified in other sections of Division 23. The drawings indicate the general arrangement of piping, fittings and specialties. The following are specific connection requirements:
 1. Install thermometers and gauges piping adjacent to equipment to allow servicing and maintaining of equipment.

END OF SECTION 23 12 30

**SECTION 23 12 35
MANUAL AIR VENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Specifications of this Division complement the requirements of this Section.

1.02 SUMMARY

- A. This Section specifies materials and installation methods for manual air vents utilized in hydronic piping systems. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.
- B. MSS Compliance:
 - 1. MSS SP-110-92 Threaded Ball Valves

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide air vent valves as manufactured by one of the following:
 - 1. Apollo
 - 2. Hammond
 - 3. Hydronic Components, Inc. (a division of Jomar)
 - 4. Jomar Valve
 - 5. Milwaukee
 - 6. Nibco
 - 7. Stockham
 - 8. Watts

2.02 MANUAL AIR VENTS

- A. Manual air vents shall consist of ¾" ball valves (specified in other sections) with hose thread outlet. Construct valves of bronze body, two piece, full port ball valves with lever handle, Teflon seats, chrome plated brass ball, brass stem and threaded ends, 600 psi CWP.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion.
- B. Operate valves in positions from fully open to fully closed.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Do not attempt to repair defective valves; replace with new valves.

3.02 INSTALLATION

- A. Provide 1/2" air vents at all piping high points to allow air venting. Extend 3/8" soft copper from valve outlet elbowed downward-away from pipe or insulation.

- B. All manual air vents shall be installed in accessible locations in a position to allow full stem movement.

END OF SECTION 23 12 35

SECTION 23 12 36 AUTO AIR VENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Specifications of this Division complement the requirements of this Section.

1.02 SUMMARY

- A. This Section specifies materials and installation methods for automatic air vents utilized in hydronic piping systems. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for air vent dimensions and design criteria.
 - 2. ASME B31.9 for building services piping air vents.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Subject to compliance with requirements, provide automatic air vents as manufactured by one of the following:
 - 1. Armstrong Machine Works
 - 2. Bell & Gossett ITT: Fluid Handling Div.
 - 3. Hoffman Specialty ITT: Fluid Handling Div.
 - 4. Honeywell
 - 5. Maid-O-Mist
 - 6. Spirax Sarco
 - 7. Taco
 - 8. Watson-McDaniel

2.02 GENERAL

- A. Where possible provide all automatic air vents of the same manufacturer. All air vents shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the air vent body.
- B. Provide factory-fabricated of types and temperature/pressure ratings as indicated, suitable for the service in which the valve is installed.
- C. Automatic Air Vents: Provide automatic air vents designed to vent air from hydraulic system automatically with float principle, composed of stainless steel float and mechanisms, cast-brass body, pressure rated for 125 psi maximum 250°F, ½" NPS inlet and outlet connections.

PART 3 EXECUTION

3.01 INSPECTION

- A. General: Examine areas and conditions under which automatic air vents are to be installed. DO not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Automatic Air Vents: Install automatic air vents at tops of air separator and elsewhere as indicated. Install shutoff valve between riser and air vent. Extend 3/8" soft copper from air vent outlet elbowed downward-away from pipe or insulation.

END OF SECTION 23 12 36

**SECTION 23 12 40
FLEXIBLE PIPE CONNECTORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies flexible pipe connectors common to more than one section of Division 23 and includes materials, specialties, and basic installation instructions.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. Portions of this Section may not be required in this project. See drawings and each specific system description section of Division 23 for specific sizes; materials and installation methods pertaining to this project.

1.03 QUALITY ASSURANCE

- A. Provide flexible pipe connectors of same type by same manufacturer.

1.04 CODES AND STANDARDS

- A. ASME Compliance: Manufacture and install flexible pipe connectors in accordance with ASME B31.9 "Building Services Piping."

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide flexible pipe connectors as manufactured by one of the following:
 - 1. Hyspan Precision Products, Inc.
 - 2. Keflex, Inc.
 - 3. Hydronic Components, Inc. (a division of Jomar)
 - 4. Mason Industries
 - 5. Metraflex
 - 6. Twin City Hose

2.02 WOVEN HOSE FLEXIBLE CONNECTORS

- A. Stainless steel hose covered with stainless steel wire braid with MPT nipples rated at minimum 600 psig working at 250°F for pipe 2" and smaller; class flanges rated at 125 psig and 240°F maximum temperature for pipe 2½" and larger.

2.03 SPHERICAL RUBBER FLEXIBLE CONNECTORS

- A. Neoprene or EPDM ("rubber") type flexible connector couplings constructed of multiple plies of nylon tire cord fabric, molded and cured in hydraulic rubber presses with galvanized steel aircraft cable flange connectors and 150 lb.

- B. Class flanges rated at 125 psig and 240°F maximum temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which flexible pipe connectors are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install where indicated on the drawings and according to manufacturer's recommendations. Install in the following locations, even if not specifically indicated on the drawings:
 1. Install spherical rubber flexible connectors at the chilled water piping connections to each chiller.
 2. Install spherical rubber flexible connectors at the chilled water piping connections to each end suction water pump.
 3. Install woven hose flexible connectors on the heating water piping connections to each boiler.
 4. Install spherical rubber flexible connectors on the heating water piping connections to each heating water pump.
 5. Install woven hose flexible connectors on the heating water piping connections to each inline water pump.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of flexible pipe connectors and after units are water pressurized, test units to demonstrate capability and compliance with requirements.
- B. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 23 12 40

**SECTION 23 12 50
COMBINATION TEMPERATURE AND PRESSURE TEST PORTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies combination temperature and pressure test ports common to more than one section of Division 23 and includes materials, specialties, and basic installation instructions.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of combination temperature and pressure test ports of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. HVAC Specialty Types: Provide HVAC specialties of same type by same manufacturer.

1.04 CODES AND STANDARDS

- A. ASME Compliance: Manufacture and install combination temperature and pressure test ports in accordance with ASME B31.9 "Building Services Piping."

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide combination temperature and pressure test ports as manufactured by one of the following:
 - 1. Flow Design, Inc.
 - 2. MG Piping Products Co.
 - 3. National Meter, Inc.
 - 4. Peterson Equipment Co., Inc.
 - 5. Sisco Manufacturing Co.
 - 6. Trerice, H.O. Co.
 - 7. Watts Industries, Inc.; Water Products Div.

2.02 MATERIALS AND SIZES

- A. Combination temperature and pressure test ports ("Pete's Plug") shall have Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with expended stem for units to be installed in insulated piping.
- B. Minimum Pressure and Temperature Rating 500 psig at 200°F.
- C. Core Inserts shall consist of one or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200°F CR.
 2. Insert material for water service at minus 30 to plus 275°F shall be EPDM.
- D. Plug size shall be ¼ inch or ½ inch, designed to be screwed into a pipe tee or “threadolet”.
Furnish plugs with gaskets and chain attached knurled caps for sealing when not in use.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which combination temperature and pressure test ports are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install test plugs in the following locations and elsewhere as indicated. Locate as close as possible to equipment or apparatus.
 1. At inlet and outlet of each air handling unit coil.
 2. At inlet and outlet of each balancing valve and reheat coil if required for proper balancing. If balancing valve is furnished with integral test plugs, additional plugs are not required.
 3. If hydronic pumps do not have a balancing valve, install test ports at inlet and outlet of pump.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of combination temperature and pressure test ports and after units are water pressurized, test units to demonstrate capability and compliance with requirements.
- B. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 23 12 50

**SECTION 23 13 10
HYDRONIC VALVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Specifications of this Division complement the requirements of this Section.

1.02 SUMMARY

- A. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 DEFINITIONS

- A. ANSI - American National Standards Institute.
- B. ASME - American Society of Mechanical Engineers.
- C. CWP - Cold Working Pressure.
- D. EPDM - Ethylene Propylene Diene Monomer.
- E. PSI - Pounds per square inch.
- F. PSID - Pounds per square inch differential.
- G. PSIG - Pounds per square inch gage.
- H. P/T - Pressure and Temperature.

1.04 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.
- B. MSS Compliance:
 - 1. MSS SP-67-90 Butterfly Valves
 - 2. MSS SP-70-90 Cast Iron Gate Valves, Flanged or Threaded Ends
 - 3. MSS SP-78-92 Cast Iron Plug Valves Flanged and Threaded
 - 4. MSS SP-80-87 Bronze Gate, Globe, and Check Valves
 - 5. MSS SP-85-85 Cast Iron Globe and Angle Valves, Flanged and Threaded Ends
 - 6. MSS SP-110-92 Ball Valves Threaded, Socket-Welded, Solder Joint, Grooved and Flared Ends
- C. All valves shall be installed in accordance with the Local Building Code.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.

3. Set ball valves open to minimize exposure of functional surfaces.
 4. Set butterfly valves closed or slightly open.
 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use a sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL

- A. Where possible provide all valves of the same manufacturer. All valves shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the valve body.
- B. Provide factory-fabricated valves of types and temperature/pressure ratings as indicated, suitable for the service in which the valve is installed.
- C. Unless otherwise indicated, provide valves of same size as the pipe in which it is installed.
- D. Where valves are to be insulated, provide an extended stem arranged to receive insulation.
- E. Operators: Provide the following special operator features:
 1. Lever handles, on quart-turn valves 6" and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 4 plug valves. (But no less than two wrenches total.)
 2. Handwheels, fastened to valve stem, for valves other than quarter turn.
 3. Chain-wheel operators, for valves 1-1/2 inch and larger, installed 72 inches or higher above finished floor elevation and called out on drawings. Extend chains to an elevation of 6"-0" above finished floor.
 4. Gear drive operators, on quarter-turn valves 8" and larger.

2.02 SHUT-OFF BALL VALVES

- A. 2" and smaller: Bronze body, two piece, full port ball valves with lever handle, Teflon seats, chrome plated brass ball, brass stem and threaded ends, 600 psi CWP. Note – manual air vents and drain valves shall be 1/2" ball valves with hose thread outlet.
- B. Acceptable Manufacturers: Subject to compliance with requirements, provide shut-off valves as manufactured by one of the following:
 1. Apollo
 2. Hammond
 3. Hydronic Components, Inc. (a division of Jomar)
 4. Jomar Valve
 5. Milwaukee
 6. Nibco
 7. Stockham
 8. Watts

2.03 SHUT-OFF BUTTERFLY VALVES

- A. 2-1/2" and larger (in welded systems): Cast iron body, lug type butterfly valves with stainless steel stem, aluminum bronze disc and EPDM liner, 200 psi working pressure. Operators: lever handles for sizes 2-1/2" to 6", gear operators for sizes 8" and larger, chain operators for sizes 6" and larger installed 10'-0" or more above the finished floor in mechanical rooms (chain shall provide operation at 6'-0" above finished floor).
- B. Acceptable Manufacturers: Subject to compliance with requirements, provide shut-off valves as manufactured by one of the following:
 - 1. Apollo
 - 2. Hammond
 - 3. Hydronic Components, Inc. (a division of Jomar)
 - 4. Metraflex
 - 5. Milwaukee
 - 6. Nexus
 - 7. Nibco
 - 8. Stockham

2.04 SILENT CHECK VALVES

- A. All sizes: Globe style, silent check valve with cast iron body, bronze seat and plug and stainless steel spring, 125 psi working pressure, with threaded ends for sizes 2-1/2" and smaller, with flanged ends for sizes 3" and larger.
- B. Acceptable Manufacturers: Subject to compliance with requirements, provide silent check valves as manufactured by one of the following:
 - 1. Crane
 - 2. Mueller
 - 3. Muessco
 - 4. Nibco
 - 5. Williams-Hager

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.02 INSTALLATION

- A. Shut-off valves shall be provided at all branch connections to piping mains, at bases of all risers, at each piece of equipment, in piping mains to sectionalize the systems and elsewhere as indicated. Valve locations shall permit proper and safe operation of all systems and facilitate maintenance and/or removal of all equipment and apparatus.

- B. All valves shall be installed in accessible locations in a position to allow full stem movement. On horizontal overhead runs, install valves with stems in the horizontal position. On horizontal runs near the floor, install valves with stem in the vertical or 45 degree angle position.
- C. In no case shall valves be installed with stems below the horizontal position.
- D. Provide 3/4" drain valves with hose thread fitting and cap with chain at all piping low points, trapped sections, bases of risers, and on equipment side of shut-off valves to permit draining.
- E. Valves shall be installed full line size. Piping reductions shall be made only at the inlet or outlet of control valves, pressure reducing valves, regulating valves, or equipment.
- F. Install silent check valves in the vertical position with stem upright and plumb. Install for proper direction of flow at discharge of pumps.

3.03 VALVE TYPE

- A. Furnish valves of the appropriate type as indicated in Table 23 13 10.1.

Table 23 13 10.1

Pipe Size	Valve Type
2" and smaller	Ball
2-1/2" and larger	Butterfly

3.04 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 23 13 10

**SECTION 23 13 35
RELIEF VALVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies hydronic relief valves and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All hydronic system components shall be installed in accordance with the Ohio Mechanical Code.
- B. All welding shall be in accordance with the Ohio Administrative Code (OAC) 4101:8-15 "Welding and Brazing" and Section IX of the ASME "Boiler and Pressure Vessel Code".
- C. All relief valves shall bear the appropriate ASME label.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Shop Drawings
 - 1. Provide Shop Drawings for each size and type of relief valve.
 - 2. Shop Drawings shall contain the following information:
 - a. General:
 - 1). Model Number
 - 2). Dimensions
 - 3). Weight
 - 4). Clearance requirements
 - 5). Material
 - 6). Color and finish
 - 7). Installation recommendations
 - 8). Ratings
 - 9). Connection/Sizes
 - b. Performance:
 - 1). Performance data as scheduled and/or specified (at a minimum)
 - 2). Code\standard compliance information
 - 3). Pressure drop curve or chart

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide relief valves as manufactured by one of the following:
 - 1. Consolidated Relief Valve Co.
 - 2. Kunkle Valve Co. Inc.
 - 3. Spence
 - 4. Spirax Sarco
 - 5. Watson McDaniel Company

2.02 GENERAL

- A. Select relief valves for full relief of capacity of equipment served in accordance with ASME Boiler and Pressure Vessel Code.

2.03 BRONZE VALVES

- A. Cast bronze body, Class 250, with threaded (MPT) inlet and threaded (FPT) outlet; stainless steel disc and trim.
- B. Factory-set valves to relieve at pressure indicated on the drawings.

2.04 CAST-IRON VALVES

- A. Cast iron body and bronze seat, Class 250; stainless steel disc and trim; threaded end connections for valves 2" and smaller, raised face flanged inlet and threaded outlet connections for valves 2-1/2" and larger.
- B. Factory-set valves to relieve at pressure indicated on the drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. Extend relief valve piping down to 6" above floor. Relief valve discharge piping shall be supported independently from valve. Shut off valves are not permitted on relief valve inlets.

END OF SECTION 23 13 35

**SECTION 23 13 40
REFRIGERANT VALVES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies refrigeration system valves, and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All refrigeration systems shall be installed in accordance with the Local Mechanical Code and the Safety Code for Mechanical Refrigeration (ANSI B9.1).

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.
- D. Shop Drawings
 - 1. Provide Shop Drawings for each type and size of valve.
 - 2. Shop Drawings shall contain the following information:
 - a. General:
 - 1). Model Number
 - 2). Dimensions
 - 3). Material
 - 4). Color and finish
 - 5). Installation recommendations
 - 6). Ratings
 - 7). All included options and accessories
 - b. Performance:
 - 1). Performance data as scheduled and/or specified (at a minimum)
 - 2). Code\standard compliance information
 - 3). Pressure drop curve or chart
 - c. Connections:
 - 1). All pipe connections, including:
 - a). Size(s)

- b). Location(s)
 - c). Connection method
- E. Operation and Maintenance Manuals
- 1. O&M Manuals shall include the following:
 - a. Final approved shop drawings, with Engineer's approval attached

PART 2 PRODUCTS

2.01 SHUT-OFF VALVES

- A. Angle pattern or straight through design, cast bronze body with cast bronze or forged brass wing cap and bolted bonnet, replaceable resilient seat disc, plated steel stem, solder ends, capable of being repacked under pressure, 450 psig working pressure, 275 °F operating temperature.

2.02 SOLENOID VALVES

- A. Two-way straight through design, forged brass, Teflon valve seat, solder ends, 400 psig working pressure, 250 °F operating temperature. Furnish complete with NEMA 1 solenoid enclosure with ½ inch conduit adapter, 24 volt, 60 Hz normally closed holding coil and manual operator to open valve.

2.03 THERMOSTATIC EXPANSION VALVES

- A. Thermostatic adjustable modulating type, complete with sensing bulb, distributor with side connection for hot gas bypass line and external equalizer line, solder ends. Size as required for specific requirements and factory set for proper evaporator superheat requirements.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide necessary valves as indicated on the drawings or as recommend by the equipment manufacturer's installation instructions for each separate refrigerant circuit for multiple compressor applications.
- B. All refrigerant valves shall be integrated into the piping system with brazed joints. Continuously purge joints while being brazed with oil-free dry nitrogen to prevent the formation of scale within the tubing.
- C. Refrigerant valves sizing and position within the piping system shall be approved by the equipment manufacturer.

3.02 TESTING AND CHARGING

- A. Test refrigerant piping with oil-free pumped dry nitrogen. Twenty four hour standing time minimum. Test low side of the system to 150 psi and high side to 300 psi. Tests shall conform to "Pressure Piping Code" 4101:8-3 and ANSI Standard B31.5 "Refrigerant Piping". Leak test piping and joints with an electronic or halide leak detector.
- B. Evacuate entire system with an approved high vacuum pump system to 500 microns. Evacuate and charge system with refrigerant as required to place equipment in operation. Provide full operating charge.

END OF SECTION 23 13 40

SECTION 23 14 10
HYDRONIC MANUAL BALANCE VALVES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SUMMARY

- A. This Section specifies valves used in hydronic piping systems and includes general descriptions and installation methods.

1.03 DEFINITIONS

- A. ANSI - American National Standards Institute.
- B. ASME - American Society of Mechanical Engineers.
- C. CWP - Cold Working Pressure.
- D. EPDM - Ethylene Propylene Diene Monomer.
- E. PSI - Pounds per square inch.
- F. PSID - Pounds per square inch differential.
- G. PSIG - Pounds per square inch gage.
- H. P/T - Pressure and Temperature.

1.04 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.
- B. All valves shall be installed in accordance with the Local Building Code.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use a sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

1.06 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 GENERAL VALVE REQUIREMENTS

- A. Where possible provide all valves of the same manufacturer. All valves shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the valve body.
- B. Provide factory-fabricated valves of types and temperature/pressure ratings as indicated, suitable for the service in which the valve is installed.
- C. Unless otherwise indicated, provide valves of same size as the pipe in which it is installed.
- D. Where valves are to be insulated, provide an extended stem arranged to receive insulation.

2.02 MANUAL BALANCING VALVES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide manual balancing valves as manufactured by one of the following:
 - 1. Flow Design Inc.
 - 2. Griswold
 - 3. Hydronic Components, Inc. (a division of Jomar)
 - 4. Nexus
 - 5. Red White Valve Corp.
- B. 2" and smaller:
 - 1. Valves shall be combination venturi and ball valve with brass body, lever handle, memory stop, two P/T ports, inlet union connection and threaded ends, 400 psi at 250°F.
- C. 2-1/2" and larger:
 - 1. Valves shall be butterfly throttling valve with separate venturi flow meter. Assembly shall be rated for 240 psi at 250 degrees F and shall have an accuracy of +/-3%.
 - 2. Butterfly Valve shall have cast iron lug-type body meeting ANSI class 125/150, with EPDM gasket and seat, 416 stainless steel stem, bronze sleeve bearing and aluminum or bronze disc.
 - 3. Venturi flow meter shall be constructed of Steel body, meeting ASTM A120, with low loss piezo-ring throat. Venturi shall have differential readout ports consisting of extended superseal pressure and temperature test ports. Provide venturi's with flanged connections, rated at 125 psig working pressure and constructed of cast iron. Venturis shall have a precision machined throat with an accuracy of 3%. Permanent pressure drop through the venturi's shall not exceed 2 feet at design flow.

2.03 THROTTLING VALVES

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide throttling valves as manufactured by one of the following:
 - 1. Dezurik
 - 2. Key Port
 - 3. Val-Matic
- B. Throttling valves 2-1/2" and larger shall be plug valves constructed of cast iron body, stainless steel trim, resilient faced plug with flanged ends and memory stop, 150 psi working pressure. Provide square head operators for sizes 2-1/2" to 4"; gear operators for sizes 6" and larger.
- C. Provide one wrench for every four valves with a minimum of two wrenches. Wrenches shall be locked in place with a set screw.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.02 INSTALLATION

- A. All valves shall be installed in accessible locations in a position to allow full stem movement. On horizontal overhead runs, install valves with stems in the horizontal position. On horizontal runs near the floor, install valves with stem in the vertical or 45 degree angle position.
- B. In no case shall valves be installed with stems below the horizontal position.
- C. Install all piping with reduction in size being made only at the inlet and outlet of control valves, regulating valves and equipment. All hydronic manual balance valves shall be installed full line size.
- D. Install balancing valves with at least the minimum straight length of pipe, upstream and downstream of the valve, required by the manufacturer for maximum accuracy.

3.03 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing.
- B. Replace valves if persistent leaking occurs.

3.04 APPLICATION

- A. Manual balancing valves (2" & smaller): All terminal units, where indicated on drawings
- B. Manual balancing valves (2-1/2" & larger): Air handling unit coils
- C. Flow throttling valves: Pump Discharges

END OF SECTION 23 14 10

SECTION 23 14 20
HYDRONIC AUTOMATIC BALANCE VALVES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies automatic balance valves used in hydronic piping systems and includes general descriptions and installation methods. See Drawings for specific sizes and installation requirements.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 DEFINITIONS

- A. ANSI - American National Standards Institute.
- B. ASME - American Society of Mechanical Engineers.
- C. CWP - Cold Working Pressure.
- D. EPDM - Ethylene Propylene Diene Monomer.
- E. PSI - Pounds per square inch.
- F. PSID - Pounds per square inch differential.
- G. PSIG - Pounds per square inch gage.
- H. P/T - Pressure and Temperature.

1.04 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

1.06 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Subject to compliance with requirements, provide automatic balancing valves as manufactured by one of the following:
 - 1. Flow Design, Inc.
 - 2. Griswold
 - 3. Hydronic Components, Inc. (a division of Jomar)
 - 4. Nexus Valve, Inc.
 - 5. Red White Valve Corp.

2.02 GENERAL

- A. Where possible provide all valves of the same manufacturer. All valves shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the valve body.
- B. Provide factory-fabricated valves of types and temperature/pressure ratings as indicated, suitable for the service in which the valve is installed.
- C. Unless otherwise indicated, provide valves of same size as the pipe in which it is installed.
- D. Where valves are to be insulated, provide extended ports arranged to receive insulation.

2.03 AUTOMATIC BALANCING VALVES

- A. Provide factory calibrated, direct acting, automatic pressure compensating type automatic balancing valves. The GPM for the automatic flow control valves shall be factory set and shall automatically limit the rate of flow to within 5% of the specified GPM over at least 95 percent of the control range.
- B. Each flow cartridge shall be self-cleaning, constructed with stainless steel moving parts and be accessible without the use of special tools. The flow cartridge's non-clogging orifice design shall include no metal-to-metal contact, no segmented ports, and incorporate a flow nozzle and metering disk controlled by a pressure compensating spring.
- C. The flow cartridge shall be factory flow tested and calibrated to maintain accuracy of $\pm 5\%$; the accuracy shall be maintained over an operating range of 2 – 32 PSID.
- D. Manufacturer shall provide cartridge exchange for up to one (1) year from date of delivery at no charge. Exchange shall be provided for flow rate changes within same valve body.
- E. Flow cartridges shall carry a 5 year material warranty.
- F. Valves 2" and smaller shall have brass Y-pattern body with integral ball valve, (2) pressure/temperature test ports, a tag indicating the model, flow rate and PSID range, blowout proof stem with dual Viton o-ring seals, interchangeable union end with Viton o-ring seal, hard chrome plated full-port ball with Teflon seats, and rated at 600 PSI WOG, 325 degrees F. Valves shall have threaded connections. The flow cartridge shall be removable from the Y-body housing without the use of special tools to provide access for regulator change-out, inspection and cleaning without breaking the main piping.
- G. Valves 2½" and larger shall be a wafer style ductile iron or cast iron body with pressure and temperature test plugs across the flow cartridges; a tag indicating the model, flow rate and operating control range; with a drain and rated at 150 PSI, 275° F.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent cartridge movement during shipping and handling.
- B. Examine threads on valve and mating pipe for form and cleanliness.

- C. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- D. Do not attempt to repair defective valves; replace with new valves.

3.02 INSTALLATION

- A. All valves shall be installed in accessible locations.
- B. Install valves with at least the minimum straight length of pipe, upstream and downstream of the valve, required by the manufacturer for maximum accuracy.
- C. Install all piping with reduction in size being made only at the inlet and outlet of control valves, regulating valves and equipment. All hydronic automatic balance valves shall be installed full line size.

END OF SECTION 23 14 20

SECTION 23 15 10
FLOW MEASURING DEVICE - VENTURI

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies Venturi flow meters and includes materials, accessories, and basic installation instructions. See drawings and each specific system description section of Division 23 for specific sizes; materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. ASME Compliance: Manufacture and install Venturi meters in accordance with ASME B31.9 "Building Services Piping."

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Provide flow measuring venture meters as manufactured by one of the following:
 - 1. Bell + Gossett
 - 2. Flow Design Inc.
 - 3. Griswold
 - 4. Nexus
 - 5. Taco, Inc.

2.02 VENTURIS

- A. Provide flow measuring venturis, where indicated on the drawings. Venturis shall have a precision machined throat with an accuracy of 3%. Venturi shall have differential readabout ports. Permanent pressure drop through the venture shall not exceed 2 feet at design flow.
- B. Venturis 2" and smaller shall have threaded connections, rated at 125 psig working pressure and be constructed of bronze or brass. Venturis 2-1/2" and larger shall have flanged connections, rated at 125 psig working pressure and be constructed of cast iron.
- C. Venturi shall have differential readout ports fitted with check valve and protective cap.
- D. Where indicated, provide venturi with a throttling valve with a memory stop on the downstream side of the venture. Provide full port ball valves (sizes 1/2" – 2") with brass or bronze body, blowout-proof stem, virgin Teflon seats, brass stem and packing nut and a steel handle.
- E. All butterfly valves 2" tom 14", shall be cast iron full-lug type, with EPDM seat, 416 s.s. stem, bronze sleeve bearing and an alum./bronze disk.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which flow measuring Venturis are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install venturis in accessible locations according to manufacturer's recommendations. Maintain manufacturer's required minimum lengths of straight pipe both upstream and downstream.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of flow measuring venturi's, and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 23 15 10

SECTION 23 16 10
CLOSED LOOP WATER TREATMENT SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies chemical treatment for closed loop water systems and includes necessary chemicals and equipment for cleaning and flushing of systems to inhibit development of scale, corrosion, and biological growth.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. Provide water treatment and chemicals for the following systems:
 - 1. Heating hot water system
 - 2. Chilled Water system

1.03 QUALITY ASSURANCE

- A. Equipment Manufacturer Qualifications:
 - 1. Shall be able to document a minimum of **10 YEARS** experience designing, manufacturing and supplying products for commercial and industrial water treatment and water chemistry control.
 - 2. Shall maintain engineering and field service capabilities to ensure proper operation of product within the service period specified in subsequent sections.
 - 3. Shall be able to document the treatment program for the first year of operations including:
 - a. Assurance of manufacturer examination service reports.
 - b. Program for noting and communicating deviations reported.
 - c. Lines of responsibility for corrective actions to cure deviations.
 - 4. Shall be registered with the US EPA registration as pesticide, device or active ingredient producing establishment.
- B. Chemical Supplier and Water Treatment Service Company Qualifications:
 - 1. Facilities:
 - a. Shall have their own laboratory for analysis of water samples, deposit analysis and metallurgical analysis and technical assistance.
 - 2. Scope of Service:
 - a. Shall schedule service in order to evaluate monitoring tools, testing protocol, control limits, and to provide electronic reports or acceptable alternative for each visit.
 - b. Shall be able to respond on emergency basis within 2 hours by phone and within 24 hours on site.
 - c. Shall perform on site inspections of equipment with three days notice by customer providing report on findings.
 - 3. Shall provide start-up assistance and commissioning assistance as required without additional cost to the owner.

4. Shall have a minimum of ten years experience in the water treatment business, have laboratory facilities and staff capable of performing all necessary analyses relating to the performance of water treatment program.
5. Shall furnish products ready to use.
6. Shall be registered with the US EPA registration as pesticide, device or active ingredient producing establishment.

1.04 CODES AND STANDARDS

- A. UL and NEMA Compliance: Provide electrical components required as part of water treatment equipment, which are UL listed and labeled, and comply with NEMA Standards.
- B. NEC Compliance: Comply with NEC as applicable to installation and electrical connections of ancillary electrical components of water treatment equipment.
- C. Chemical Standards: Provide only chemical products which are acceptable under state and local pollution control regulations.

1.05 REFERENCES

- A. ABMA - American Boiler Manufacturing Association.
- B. ASME Boiler and Pressure Vessel Code - Section VIII; Ruler for the Construction of Pressure Vessels Division 1.
- C. ASTM G4-01(2008) Standard for Conducting Corrosion Coupon Tests in Field Applications.
- D. CTI Code STD-149(00) Corrosion Testing Procedures, Corrosion Coupon Testing and Test Devices.
- E. OSH Regulations Standards – 29CFR, PART 1900, Standard 1200, Toxic and Hazardous Substances (MSDS).
- F. SMEWW (2004) – Standard Methods for the Examination of Waste Water.
- G. US Federal Communications Commission CFR 47(FCC) PART 18, 2006 for radiated emissions.
- H. US Environmental Protection Agency (EPA) FIFRA compliance as per 7 U.S.C. SS 136e and US EPA compliance as per 40CFR PART 167.
- I. US EPA – EPP – Environmentally Preferred Purchases including in Executive Order 13423 – Strengthening Federal Environmental, Energy, and Transportation Management.

1.06 SUBMITTALS

- A. Shop Drawings:
 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 1. Special
 2. MSDS Sheets: Submit copies of MSDS sheets for all chemicals utilized in the water treatment process
 3. Raw Water Analysis: Submit a copy of the project site water analysis to document the water quality available at the project site.

1.07 WATER ANALYSIS

- A. Prior to the final determination of the requirements of the water treatment program, an analysis shall be made of all waters to be treated. This includes the testing of any systems that are to be expanded, or supply water to any new system.

- B. Testing shall be performed in a recognized laboratory under the direction of the water treatment Contractor.
- C. Raw water test analysis shall include at a minimum the analysis of the following compositions of the water:
 - 1. Calcium Hardness (as ppm CaCO₃)
 - 2. Total Hardness (as ppm CaCO₃)
 - 3. Total Alkalinity or m-Alkalinity (as ppm CaCO₃)
 - 4. Ph
 - 5. Silica (as SiO₂)
 - 6. Specific Conductivity (μS/cm)
 - 7. Sulfate (as SO₄)
 - 8. Chloride (as Cl⁻)
 - 9. Phosphate (as PO₄)

1.08 EXTENDED MAINTENANCE SERVICES

- A. Agreement to Maintain: Prior to time of final acceptance, submit 4 copies of "Agreement for Continued Service and Maintenance" for water treatment system, for Owner's possible acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing, and including replacement of materials and equipment, for one-year period with option for yearly renewal of Agreement by Owner.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products and service by one of the following manufacturers and their authorized representative:
 - 1. GLA Water Treatment – Contact Paul Kobus, cell: (440) 343-1824
 - 2. Chem Treat Inc. – Contact Joe Royle, cell: (216) 401-1843
 - 3. ChemAqua – Contact Bill Messick, cell: (216) 870-6798
 - 4. Aquascience.
 - 5. Calgon
 - 6. Dolphin WaterCare: A Division of Clearwater Systems Corporation.
 - 7. DuBois Chemicals, Inc.; Div. of Diversey Corporation.
 - 8. GE Infrastructure.
 - 9. Patriot Industrial Technologies LTD
 - 10. Watcon, Inc.

2.02 BY-PASS (POT) FEEDERS

- A. Approved manufacturer: Subject to compliance with requirements, provide products as manufactured by one of the following:
- B. Aqua Science
- C. Griswold Water Systems
- D. H-O-H Water Technology, Inc.
- E. Neptune type BDF, FTF, or approved equal.
- F. Sumco Technologies, Ltd.

- G. Vector Industries, Inc.
- H. Provide bypass feeders with a capacity of 5 gallons. The feeder shell shall be constructed of 11 gauge steel minimum for 2 gallon units and 10 gauge steel minimum for 5 gallon and larger units. Tank heads shall be a minimum of 11 gauge steel for 2 gallon units and a minimum 9 gauge steel for 5 gallon units. The bypass feeder shall be rated at 300 psi and to 200°F.
- I. The tank shall have a wide mouth, minimum 3-1/2" opening so that chemical addition can be performed without the need of a funnel. The bypass feeder shall have a continuous threaded closure requiring 2-1/2 turns to close and seal. Closures using partial threads or lugs shall not be considered.
- J. The cap shall be constructed of cast iron with an epoxy-coated underside to prevent corrosion and shall use a square ring gasket seal. The ring gasket shall not be glued or restrained from movement. Closures using "o" rings or gaskets which are glued or restrained from free movement by snap rings shall not be considered equal.
- K. Options:
 - 1. Legs – The bypass feeder shall be provided with legs to elevate the feeder off the floor. The legs shall have holes to allow mounting by anchor bolts.
 - 2. Filter –
 - a. Bag Filter – The bypass feeder shall be provided with a 5 micron filter bag fully supported by a stainless steel filter basket for simultaneous side stream filtering.
 - b. Cartridge Filter – The bypass feeder shall be provided with a 5 micron cartridge filter for simultaneous side stream filtering.
- L. Furnish five (5) additional 5 micron filter bags. Obtain receipt from Owner.

2.03 CLOSED CIRCUIT WATER TREATMENT

- A. Cleaning Chemical: This material shall be a blend of organic dispersant, polymers, caustic conditioners and corrosion inhibitors, with a 1% solution having a pH of 10. Chemical shall be injected at the rate of 1.5 gallons/1000 gallons of water maintaining 400 PPM hydroxide alkalinity. During cleaning, the iron reading shall not exceed 20 PPM and TDS shall not exceed 3000 M/M. If either level is exceeded, discharge solution and add fresh water and cleaning solution until above limits are maintained.
- B. Water treatment for closed water loops systems shall, after cleaning and flushing, add a nitrite/molybdate or equivalent chemical product which is designed specifically for the system metallurgy and water conditions, such as DuBois Isogard, Omnigard or equivalent.
 - 1. Nitrite level in closed water loops treated primarily with nitrite components shall be maintained between 750 and 1,200 on butrate at all times unless otherwise indicated by corrosion coupon data.
 - 2. pH control shall be maintained by product selection as recommended by the chemical water treatment system Contractor.
- C. In loops treated with products of molybdenum and synergistic components, molybdenum level should be maintained at 12-15 ppm unless otherwise indicated by corrosion coupon data or supplier recommendations.

2.04 WATER SERVICE PROGRAM

- A. The chemical treatment system supplier shall provide chemical and consulting services for 1 year from date of acceptance of system by the Owner. Minimum service requirements shall include:
 - 1. Quarterly sample and testing.
 - 2. Additional chemicals if needed for closed loop systems.

3. Bypass feeder filter change.
 4. Testing of: PH, alkalinity, conductance, inhibitor, microbiological dip slide, and % glycol.
 5. Visual check of system.
 6. Written report documenting all of the items above.
- B. Service program shall include technical assistance to the Contractor during installation, supervision of chemical cleaning, and instructions of Owner's personnel in the operation, monitoring, and control of each chemical treatment system.
 - C. The chemical treatment system supplier shall maintain a continuing program of service and supervision, including a service call every 3 months during the first year after system start-up.

PART 3 EXECUTION

3.01 INSPECTION

- A. General: Examine areas and conditions under which water treatment systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the Installer.

3.02 INSTALLATION OF WATER TREATMENT SYSTEM

- A. General: Install water treatment system in accordance with manufacturer's written instructions.
- B. The filter feeder shall be piped across the circulating pump, or as otherwise indicated or required to insure positive flow through the tank. It shall be piped so that direction of flow is in the bottom and out the top. All piping to and from the feeder shall be schedule 80 black steel.
- C. The feeder shall be firmly mounted to a wall, column, etc. or placed on a floor stand, and not supported by the supply and return piping.
- D. The filler opening shall be not more than 48 inches above the floor for ease of use and to avoid any splashing of chemicals on the operator.
- E. Coordinate work with plumbing and piping work as necessary to interface components of the water treatment system properly with the piping system. Route drain lines to appropriate drain inlet.
- F. Mount pressure gages, valves, and controls furnished by manufacturer, in accordance with manufacturer's instructions.

3.03 CONNECTIONS TO EXISTING CLOSED CIRCUIT SYSTEMS

- A. General: This project includes additions to and extensions of existing closed circuit hydronic systems where shown and noted on the Drawings.
- B. Expansion and modifications to the existing hydronic systems will be numerous and substantial. This Section includes the requirements for pre-cleaning, flushing, filling, etc. of all new pipe **prior to connecting to the existing systems**. This Section will also include intermediate hydronic system testing, maintenance, and chemicals required during system tie-ins lasting the duration of the entire construction project for the entire building hydronic system. Upon completion of the entire construction project, final testing and system acceptance will be required by this Section.
- C. Once construction starts and the first hydronic system tie-in is made, this Contractor will be required to coordinate with the Owner to maintain the entire water treatment system for all

affected closed circuit hydronic water systems. This contractor shall be required to maintain the entire water treatment system for all existing closed loop systems. This includes monthly test submitted to the Owner, Engineer and Construction Manager to verify proper water treatment is being maintained. This monthly testing will be required until all new work is complete, finished and accepted by the Owner and Engineer.

- D. **Precleaning and System Flushing:** **Prior to any existing system connection**, all new piping must be flushed and precleaned. Testing of the new piping system must be reviewed and approved prior to any final connecting or tie-in to the main system.
- E. **Circulation Pump:** This Contractor must include a temporary circulation pump sufficient to circulate the entire new piping system. Pump will need to be available for the duration of the entire project. Pump dynamic head must be sufficient to circulate water through the entire portions of new piping and flow must be a minimum of 50% of the anticipated connected flow rate for that section of piping. Temporary power for this pump, either single phase or multi-phase, will be the responsibility of this Contractor to coordinate and provide.
- F. **Temporary Shot Feeder/Filter:** Provisions to add the necessary precleaning chemicals must be provided by the Contractor. The shot feeder is to be a two (2) gallon combination filter feeder. The feeder shall consist of a tank body, a stainless steel dissolving basket which holds a fully supported 40 micron filter bag. The filter feeder shall be piped across the temporary circulating pump, to insure positive flow through the tank. It shall be piped so that direction of flow is in the bottom and out the top. The filler opening shall be not more than 48 inches above the floor for ease of use and to avoid any splashing of chemicals on the operator. Furnish 5 additional 40 micron filter bags for use during temporary flushing.
- G. **Skid Mounted Portable Unit:** The circulation pump, combination filter feeder, and piping shall be skid mounted for easy movement and to minimize set-up time for preliminary system flushing and precleaning. Piping must include provisions for a fresh water fill connection and a full size (minimum 2" NPS) drain connection. Flexible hoses can be used for open site drain connections. A water meter shall be incorporated to determine the volume of the system to be treated.
- H. **By-Pass Piping:** Each partial section of hydronic piping must be looped back to itself to allow full circulation. This Contractor must include whatever temporary valves, fittings, vents, fill valves, pipe, etc. is required in order to completely circulate the new pipe system prior to final connection to the existing building systems. All new strainers are to be included in the hydronic system precleaning, flushing loop; final cleaning of all strainer screens is the responsibility of this Contractor.

3.04 CLEANING AND FLUSHING

- A. Water used for hydrostatic testing shall be drained from the system to be cleaned.
- B. Prior to placing the water system in operation, the entire water system shall be cleaned and flushed in accordance with the manufacturers written recommendations, using DuBois Met-All Terj or Liquid 422 or equivalent.
- C. Following the precleaning procedures, pre-filming procedures shall be implemented according to the specifications using DuBois Passivate Plus PBB or equivalent product, following guidelines per package instructions.

3.05 CLOSED CIRCUIT WATER TREATMENT SYSTEMS

- A. General: Provide a chemical treatment system to control corrosion in each closed water system. All necessary cleaning and corrosion inhibitor chemicals, feed equipment, test equipment, service, and monitoring shall be furnished by the chemical treatment system supplier and installed by the Contractor.
- B. Cleaning and Filling Procedure:
 - 1. Each closed water system shall be filled and flushed with clean water.
 - 2. The system shall then be refilled with clean water to which appropriate cleaning chemicals have been added to remove pipe dope, fabrication lubricants, oils, welding slag, loose mill scale, and other extraneous materials. The system shall then be circulated for at least 48 hours, drained, and flushed with clean water.
 - 3. After the cleaning chemicals have been thoroughly flushed from the system, the system shall be refilled with clean water to which the appropriate scale and deposit inhibitors, corrosion inhibitors, and microbiological control agents have been added.

3.06 DELIVERY, STORAGE, AND HANDLING

- A. Equipment and Accessories:
 - 1. Comply with manufacturer's instructions. Store in original packaging.
 - 2. Store in a dry location, protected from the elements, and from mud, dirt and soiling.
 - 3. Protect components from damage during storage and handling.
 - 4. Handle with care to prevent damage during movement and installation.
- B. Chemical Products and Supplies
 - 1. Store in original packaging with intact factory labeling in a dry location, protected from the elements, and from mud, dirt and soiling.
 - 2. Observe label instructions for handling and storage conditions.
 - 3. Provide liquid containment protection.
 - 4. Provide to the construction supervisor or owners representative all MSDS information for products on the site.

3.07 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.08 START-UP

- A. Start-up Procedures: During system startup, operate each water treatment system (after charging with specified chemicals) to maintain required steady-state characteristics.

3.09 SERVICE PROGRAM

- A. The chemical treatment system supplier shall provide a service program which shall include technical assistance to the Contractor during installation, supervision of chemical cleaning, and instructions of Owner's personnel in the operation, monitoring, and control of each chemical treatment system.
- B. The chemical treatment system supplier shall maintain a continuing program of service and supervision, including a service call each month during the first year after system start-up.

3.10 FIELD QUALITY CONTROL

- A. Engage a water treatment service representative to perform startup of service.
 - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

2. Clean system as previously describe.
3. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational.
4. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

3.11 ADJUSTING

- A. First Year Monitoring Service
 1. Every 90 days from Initial Start-up Service, a water treatment representative shall monitor the performance of the system.
 2. A written Service Report shall be provided to the owner/operator. The monitoring report shall include the following:
 - a. Inspection of the System for functionality.
 - b. Inspection of filtration, automation and equipment for operation and condition.
 - c. Visual inspection of overall system condition as accessible. Service visits may be timed to coincide with the opening of certain system components such as a closed vessel or chiller.
 - d. At each service visits, a field analysis of the following water chemistry parameters shall be performed using field test kits.
 - 1). Total Bacteria Count, planktonic (by prepackaged dipslide)
 - 2). pH
 - 3). Specific Conductivity(μ S/cm)
 - 4). Chloride(as Cl-)
 - 5). Total Hardness (as ppm CaCO₃)
 - 6). Total Alkalinity or m-Alkalinity (as ppm CaCO₃)
 - 7). Calcium Hardness (as ppm CaCO₃)

3.12 TRAINING OF OWNER'S PERSONNEL

- A. Provide services of supplier's technical representative for two (2) separate-four hour days to instruct Owner's personnel in operation, maintenance, and testing procedures of each water treatment system.

END OF SECTION 23 16 10

**SECTION 23 17 11
COALESCING AIR SEPARATORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies air separators common to more than one section of Division 23 and includes materials, specialties, and basic installation instructions.
- B. See drawings and each specific system description section of Division 23 for specific sizes; materials and installation methods pertaining to this project.
- C. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air separators, of types and capacities required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Provide air separators of same type by same manufacturer.

1.04 CODES AND STANDARDS

- A. ASME Compliance: Manufacture and install air separators in accordance with ASME B31.9 "Building Services Piping."
- B. UL and NEMA Compliance: Provide electrical components of HVAC specialties which are listed and labeled by UL, and comply with NEMA standards.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept equipment on site in shipping containers with labeling in place. Immediately inspect for damage.
- B. Protect piping components from entry of foreign materials by providing temporary end caps and closures on piping and fittings. Maintain end caps in place until installation.

1.06 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide air separator as manufactured by one of the following:
 - 1. Bell & Gossett ITT; Fluid Handling Div.
 - 2. Spirotherm, Inc.
 - 3. Taco, Inc.
 - 4. Thrush Co., Inc.

2.02 GENERAL

- A. Separator shall utilize a coalescing separation method, utilizing internal pall rings.
- B. Device shall be either standard or high velocity, as indicated on the drawings.

2.03 CONSTRUCTION

- A. Unit must be constructed in accordance with the ASME boiler and pressure vessel code and stamped 125 psig design pressure.
- B. Air separation and removal device shall be constructed of steel. It shall be designed, fabricated and stamped per ASME Section VIII Division 1 with a maximum working pressure of 125 psi at 270°F.
- C. The air and dirt separator shall employ the use of high surface area pall rings to achieve optimal separation of air and dirt with minimal pressure drop. The pall ring shall be made of stainless steel. Stainless steel will be the only acceptable material used for suppressing turbulence and increasing surface area for high efficiency air and dirt removal. Inferior materials of construction such as copper for the straining medium will not be acceptable.
- D. Each air and dirt removal device shall be equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. The air vent shall be able to be closed to allow flushing and purging of dirt via side port without dirt passing through vent on initial system fill.
- E. The unit manufacturer shall provide the Owner and Design Engineer third party independent test data certifying that their unit performs to the above standards. Suppliers not providing these independent performance test results will not be acceptable.

2.04 CONNECTIONS

- A. Connections shall be flanged, regardless of inlet and discharge pipe connection size. Flange bolt hole patterns shall be per ASME.
- B. Unit shall have separate top fittings for connection to system expansion tank and for automatic air vent. The unit shall have a bottom connection for blowdown cleaning.

2.05 ACCESSORIES

- A. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and removal of the floating impurities from the air system interface within the separator.
- B. A blow down valve shall be provided by the unit manufacturer on the bottom of each unit to allow blow down and cleaning. On units 2 1/2" and smaller the valve and all of its fittings shall be 1". On units three 3" and larger the valve and all openings shall be 2".

2.06 AUTOMATIC AIR VENTS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide vent valves of one of the following:
 - 1. Armstrong Machine Works
 - 2. Bell & Gossett ITT; Fluid Handling Div.
 - 3. Hoffman Specialty ITT: Fluid Handling Div.
- B. Provide automatic air vents designed to vent automatically with float principle, stainless steel float and mechanisms, cast-iron body, pressure rated for 125 psi, 1/2" NPS inlet and outlet connections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which air separators are to be installed.

- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Air Separator: Install air separator at high point of heating water supply piping. Connect inlet and outlet piping. Run 3/4 inch piping to expansion tank. Install one (1) inch ball type blowdown valve and cap. Install automatic air vent at top of air separator with shutoff valve.
- B. Automatic Air Vents: Install automatic air vents at tops of air separator and elsewhere as indicated. Install shutoff valve between riser and vent valve.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of air separators and after units are water pressurized, test units to demonstrate capability and compliance with requirements.
- B. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new unit and proceed with retesting.

END OF SECTION 23 17 11

**SECTION 23 17 30
STRAINERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies strainers used in hydronic piping systems and includes general descriptions and installation methods.

1.03 DEFINITIONS

- A. The following are definitions and abbreviations used in this section:
 - 1. ASME - American Society of Mechanical Engineers.
 - 2. ASTM - American Society for Testing and Materials.
 - 3. EPDM - Ethylene Propylene Diene Monomer.
 - 4. NPT - Nominal Pipe Thread.
 - 5. PSI - Pounds per square inch.

1.04 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare strainers for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
- B. Use the following precautions during storage:
 - 1. Maintain end protection.
 - 2. Store indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.
- C. Use a sling to handle large strainers; rig sling to avoid damage to exposed parts.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Prepare strainers for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
- B. Use the following precautions during storage:
 - 1. Maintain end protection.

2. Store indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.

C. Use a sling to handle large strainers; rig sling to avoid damage to exposed parts.

PART 2 PRODUCTS

2.01 GENERAL

- A. Where possible provide all strainers of the same manufacturer. All strainers shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the strainers body.
- B. Provide factory-fabricated strainers of types and temperature/pressure ratings as indicated, suitable for the service in which the strainers are installed.
- C. Unless otherwise indicated, provide strainers of same size as the pipe in which it is installed.
- D. Where strainers are to be insulated, leave cap accessible.

2.02 HYDRONIC STRAINERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide strainers as manufactured by one of the following:
 1. Apollo
 2. Armstrong
 3. Hammond
 4. Hydronic Components, Inc. (a division of Jomar)
 5. ITT Hoffman
 6. Milwaukee
 7. Mueller
 8. Nibco
 9. Spirax Sarco
 10. Stockham
 11. Watts
- B. Strainers 2" and Smaller in Copper pipe:
 1. Cast bronze body
 2. 304 stainless steel screen:
 - a. Sizes ¼" through ½": 40 mesh, 0.010" wire
 - b. Sizes ¾" through 2": 20 mesh, 0.016" wire
 3. Operating pressure/temperature: 400 PSI, at 400°F
 4. Brass plug
 5. Furnish with threaded connections
- C. Strainers 2" and Smaller in Steel pipe:
 1. Cast iron body
 2. 304 stainless steel screen:
 - a. Sizes ¼" through ½": 40 mesh, 0.010" wire
 - b. Sizes ¾" through 2": 20 mesh, 0.016" wire
 3. Operating pressure/temperature: 400 PSI, at 400°F

4. Malleable iron plug
 5. Furnish with threaded connections
- D. Strainers 2-1/2" and larger:
1. Cast iron body, ASTM A126-B
 2. Cover, carbon steel ASTM A36
 3. Gaskets, EPDM (non asbestos)
 4. "Y" configuration
 5. Class 125 (150 psi at 150 deg F.)
 6. Screen shall be type 304 stainless steel with 1/16" (0.062") perforations for sizes 4" and smaller; 1/8" for 5" and larger
 7. Furnish with NPT blowdown outlet with ball valve and hose thread cap
 8. Furnish with flanged connections

2.03 STEAM STRAINERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide strainers as manufactured by one of the following:
1. Armstrong
 2. Hoffman
 3. Mueller
 4. Spirax Sarco
- B. Strainers 2" and Smaller:
1. Cast Iron body, per ASTM A126 Class B
 2. Furnish with metal filled Grafoil gasket
 3. 304 stainless steel screen:
 - a. Sizes 1/2" through 2": 1/32" openings
 4. Ratings: 250psi at 400 deg F.
 5. Self-cleaning design, furnish with blow-down plug or gate valve, as indicated on the drawings.
 6. Furnish with NPT threaded connections
- C. Strainers 2-1/2" and larger:
1. Cast iron body, ASTM A126-B
 2. Cover, carbon steel ASTM A36
 3. Gaskets, EPDM (non asbestos)
 4. "Y" configuration
 5. Ratings:
 - a. Class 125 (150 psi at 200 deg F) for low and medium pressure systems
 - b. Class 250 (250 psi at 450 deg F) for high pressure systems
 6. Screen shall be type 304 stainless steel with 3/64" perforations.
 7. Furnish with NPT blowdown outlet with gate valve and hose thread cap

8. Furnish with flanged connections

PART 3 EXECUTION

- A. Examine strainer interior for cleanliness, freedom from foreign matter, and corrosion.
- B. Examine threads on strainer and mating pipe for form and cleanliness.
- C. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- D. Do not attempt to repair defective strainers; replace with new.

3.02 INSTALLATION

- A. Strainers shall be installed at the inlet to each pump and elsewhere as indicated on the drawings.
- B. Locations and orientation shall be as recommended by the manufacturer for proper operation, and to facilitate proper maintenance access and removal of internal screening apparatus. Install steam strainers horizontally in horizontal pipe.
- C. Install all piping with reduction in size being made only at the inlet and outlet of control valves, regulating valves and equipment. All strainers shall be installed full line size.

3.03 ADJUSTING

- A. Clean strainer mesh after piping systems have been tested and put into service but before final adjusting and balancing.

END OF SECTION 23 17 30

SECTION 23 17 31 WYE STRAINERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies strainers used in hydronic piping systems and includes general descriptions and installation methods.

1.03 DEFINITIONS

- A. The following are definitions and abbreviations used in this section:
 - 1. ASME - American Society of Mechanical Engineers.
 - 2. ASTM - American Society for Testing and Materials.
 - 3. EPDM - Ethylene Propylene Diene Monomer.
 - 4. NPT - Nominal Pipe Thread.
 - 5. PSI - Pounds per square inch.

1.04 QUALITY ASSURANCE

- A. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare strainers for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
- B. Use the following precautions during storage:
 - 1. Maintain end protection.
 - 2. Store indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.
- C. Use a sling to handle large strainers; rig sling to avoid damage to exposed parts.

PART 2 PRODUCTS

2.01 GENERAL

- A. Where possible provide all strainers of the same manufacturer. All strainers shall have the manufacturer's name (or trademark) and pressure rating clearly marked on the strainers body.
- B. Provide factory-fabricated strainers of types and temperature/pressure ratings as indicated, suitable for the service in which the strainer is installed.

- C. Unless otherwise indicated, provide strainers of same size as the pipe in which it is installed.
- D. Where strainers are to be insulated leave plug accessible provide an extended stem arranged to receive insulation.

2.02 STRAINERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide strainers as manufactured by one of the following:
 - 1. Apollo
 - 2. Armstrong
 - 3. Hammond
 - 4. ITT Hoffman
 - 5. Milwaukee
 - 6. Mueller
 - 7. Nibco
 - 8. Spirax Sarco
 - 9. Stockham
 - 10. Watts
- B. Strainers 2" and Smaller in Copper pipe:
 - 1. Cast bronze body
 - 2. 304 stainless steel screen:
 - a. Sizes ¼" through ½": 40 mesh, 0.010" wire
 - b. Sizes ¾" through 2": 20 mesh, 0.016" wire
 - 3. Operating pressure/temperature: 400 PSI, at 400°F
 - 4. Brass plug
 - 5. Furnish with threaded connections
- C. Strainers 2" and Smaller in Steel pipe:
 - 1. Cast iron body
 - 2. 304 stainless steel screen:
 - a. Sizes ¼" through ½": 40 mesh, 0.010" wire
 - b. Sizes ¾" through 2": 20 mesh, 0.016" wire
 - 3. Operating pressure/temperature: 400 PSI, at 400°F
 - 4. Malleable iron plug
 - 5. Furnish with threaded connections
- D. Strainers 2-1/2" and larger:
 - 1. Cast iron body, ASTM A126-B
 - 2. Cover, carbon steel ASTM A36
 - 3. Gaskets, EPDM (non asbestos)
 - 4. "Y" configuration
 - 5. Class 125 (150 psi at 150 deg F.)

6. Screen shall be type 304 stainless steel with 1/16" (0.062") perforations for sizes 4" and smaller; 1/8" for sizes 5" and larger
7. Furnish with NPT blowdown outlet with ball valve and hose thread cap
8. Furnish with flanged connections

PART 3 EXECUTION

- A. Examine strainers interior for cleanliness, freedom from foreign matter, and corrosion.
- B. Examine threads on strainers and mating pipe for form and cleanliness.
- C. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- D. Do not attempt to repair defective strainers; replace with new.

3.02 INSTALLATION

- A. Strainers shall be installed at the inlet to each pump and elsewhere as indicated on the drawings.
- B. Locations and orientation shall be as recommended by the manufacturer for proper operation, and to facilitate proper maintenance access and removal of internal screening apparatus.
- C. Install all piping with reduction in size being made only at the inlet and outlet of control valves, regulating valves and equipment. All wye strainers shall be installed full line size.

3.03 ADJUSTING

- A. Clean strainer mesh after piping systems have been tested and put into service but before final adjusting and balancing.

END OF SECTION 23 17 31

**SECTION 23 18 10
BLADDER TYPE EXPANSION TANKS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies bladder type expansion tanks and includes materials, accessories, and basic installation instructions. See drawings for specific sizes and installation requirements pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Provide expansion tanks of same type by same manufacturer.

1.04 CODES AND STANDARDS

- A. ASME Compliance: Manufacture and install expansion tanks in accordance with ASME B31.9 "Building Services Piping and ASME Section VIII.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20. Indicate charge pressure in report.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept equipment on site in shipping containers with labeling in place. Immediately inspect for damage.
- B. Protect components from entry of foreign material by providing temporary end caps and enclosures on piping connections. Maintain in place until installation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide bladder type expansion tanks as manufactured by one of the following:
 - 1. Amtrol, Inc.
 - 2. Bell and Gossett ITT; Fluid Handling Div.
 - 3. John Wood Company (Alco Industries Co.)
 - 4. Patterson Pump Co., a subsidiary of the Gorman-Rupp Co.
 - 5. Taco, Inc.

2.02 GENERAL

- A. Provide expansion tank(s) of the size and type as indicated.

2.03 TANKS

- A. Tanks shall be welded steel, designed, constructed and stamped in accordance with Section VIII, Division I of ASME Boiler and Pressure Vessel Code.
- B. Tanks shall be rated for a maximum working pressure of 125 psi at 240°F.
- C. Provide tanks with the minimum acceptance volume and factory precharge pressure as indicated.

2.04 BLADDERS

- A. The bladder shall be constructed from a flexible, heavy duty butyl rubber.
- B. Where scheduled, provide internal replaceable elastomer bladder.
- C. The bladder shall be suitable for a maximum system operating temperature of 240°F.

2.05 ACCESSORIES

- A. Units shall be furnished with lifting rings.
- B. Units shall have the system connection and charging valve at the tank top and tank drain connection at the bottom.
- C. Furnish tanks with a steel base ring where indicated on the drawings to be mounted in a vertical configuration.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which bladder type expansion tanks are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. Install bladder type expansion tanks as indicated on the drawings and in accordance with manufacturer's instructions.
- B. Charge tank with proper air charge as recommended by manufacturer or indicated.
- C. Provide a shutoff isolation valve at each expansion tank connection. Remove handle and wire to valve. Tag valve – "Valve to be closed only by authorized personnel".

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of bladder type expansion tanks and after units are water pressurized, test units to demonstrate capability and compliance with requirements.

END OF SECTION 23 18 10

Editor's Note – This Section allows for hard-pipe OR flexible-hose type expansion loops. Hard-piped expansion loops need sizes shown on plans.

SECTION 23 18 20 PIPE EXPANSION COMPENSATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies piping expansion loops and fitting materials and installation methods common to more than one section of Division 23 and includes basic piping expansion loop installation instructions. Portions of this Section may not be required in this project. Similarly, other items in the Section might be superseded by more specific requirements in other sections that detail specific systems. See drawings and each specific system description section of Division 23 for specific sizes, materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all piping work described in this Section.

1.03 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Shop Drawings shall contain the following information:
 - 1). Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - 2). Alignment Guide Details: Detail field assembly and attachment to building structure.
 - 3). Schedule: For manufactured expansion loops, indicate type, manufacturer's number, size, material, pressure rating, end connections, location for each expansion joint, and the length of pipe, temperature differential and expansion/contraction length for which the flexible hose is sized.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
 - 2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS FOR MANUFACTURED EXPANSION LOOPS

- A. Manufacturers: Subject to compliance with requirements, provide flexible hose type expansion joints as manufactured by one of the following:
 - 1. Flex-Hose Co., Inc.
 - 2. Flexicraft Industries
 - 3. Flex-Pression, Ltd.
 - 4. Metraflex, Inc.
 - 5. Twin City Hose

2.02 GENERAL

- A. It is the installing contractor's option to provide hard-pipe expansion loops (of the minimum dimensions shown on the drawings) or flexible-hose type expansion joints. Pipe anchors and alignment guides shall be provided for both hard-pipe and flexible-hose type of expansion joints.
- B. The submittal schedule for flexible-hose type expansion joints shall include the specific location of each and the length of pipe, temperature differential and expansion/contraction length for which the flexible hose is sized. The following temperature differentials shall be utilized for sizing expansion joints:

Type of Pipe	Expansion/Contraction Temperature Differential (Degrees Fahrenheit)
Chilled Water	100
Heating Water	200

2.03 MANUFACTURED EXPANSION JOINTS

- A. Flexible-Hose Type Expansion Joints shall be manufactured assemblies with two flexible-metal-hose legs joined by log-radius, 180-degree return bends or a center section of flexible hose; with inlet and outlet elbow fittings, corrugated-metal inner hoses, and braided outer sheaths.
- B. Flexible-Hose Expansion Joints for Copper Piping: Copper-alloy fittings with solder joint end connections.
 - 1. NPS 2 and Smaller: Bronze hoses and double-braid bronze sheaths with 700 psig at 70 °F and 500 psig at 450 °F ratings.
 - 2. NPS 2-1/2 to NPS 4: Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 °F and 315 psig at 450 °F ratings.
- C. Flexible-Hose Expansion Joints for Steel Piping: Carbon-steel fittings with threaded end connections for NPS 2 and smaller and flanged end connections for NPS 2-1/2 and larger.
 - 1. NPS 2 and Smaller: Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 °F and 515 psig at 600 °F ratings.
 - 2. NPS 2-1/2 to NPS 6: Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 °F and 200 psig at 600 °F ratings.
 - 3. NPS 8 and Larger: Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 °F and 120 psig at 600 °F ratings.

2.04 ALIGNMENT GUIDES

- A. Manufacturers: Subject to compliance with requirements, provide alignment guides as manufactured by one of the following:
 - 1. Adscro Manufacturing, LLC.
 - 2. Advanced Thermal Systems, Inc.
 - 3. Flex-Hose Co., Inc.
 - 4. Flexicraft Industries.
 - 5. Flex-Weld, Inc.
 - 6. Hyspan Precision Products, Inc.
 - 7. Metraflex, Inc.
 - 8. Piping Technology & Products, Inc.
 - 9. Senior Flexonics, Inc.; Pathway Division
 - 10. Engineered Flexible Products

- B. Alignment guides shall be constructed of steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

2.05 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Stud: Threaded, zinc-coated carbon steel.
 - 2. Expansion Plug: Zinc-coated steel.
 - 3. Washer and Nut: Zinc-coated steel.

- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - 2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 - 3. Washer and Nut: Zinc-coated steel.

- F. Concrete: Portland cement mix, 3000 psi minimum. Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.

- G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, 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

3.01 GENERAL

- A. Provide expansion loops at the following locations as indicated on the drawings:

1. Hydronic Hot Water Piping
2. Chilled Water Piping

3.02 MANUFACTURED LOOP INSTALLATION

- A. Install manufactured, expansion loops according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
- B. Install expansion joints of sizes matching size of piping in which they are installed.
- C. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.

3.03 PIPE BEND AND LOOP INSTALLATION

- A. Pipe bend and loops shall be installed in locations and of minimum sizes as indicated on the drawings.
- B. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- C. Attach pipe bends and loops to anchors.
 1. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 2. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

3.04 SWING CONNECTIONS

- A. Connect risers and branch connections to heating water mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to heating terminal units with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to heating terminal units with at least four pipe fittings, including tee in main.

3.05 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion fittings and loops.
- B. Attach guides to pipe and secure to building structure.

3.06 ANCHOR INSTALLATION

- A. 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.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION 23 18 20

**SECTION 23 18 22
IN-LINE PIPE EXPANSION COMPENSATORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies in-line piping expansion compensator and fitting materials and installation methods common to more than one section of Division 23 and includes basic piping expansion loop installation instructions. Portions of this Section may not be required in this project. Similarly, other items in the Section might be superseded by more specific requirements in other sections that detail specific systems. See drawings and each specific system description section of Division 23 for specific sizes, materials and installation methods pertaining to this project.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all piping work described in this Section.

1.03 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping system fluids, materials, working pressures, and temperatures.
- B. Capability: Products shall absorb 200 percent of maximum axial movement between anchors.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Shop Drawings shall contain the following information:
 - 1. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - 2. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - 3. Schedule: For manufactured in-line compensator units, indicate type, manufacturer's number, size, material, pressure rating, end connections, length of pipe, temperature differential, expansion/contraction range, and location for each in-line expansion.

1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. Steel Shapes and Plates: AWS D1.1, "Structural Welding Code - Steel."
 - 2. Welding to Piping: ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS EXPANSION COMPENSATORS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide in-line type pipe expansion compensators as manufactured by one of the following:
 - 1. Hispan
 - 2. Keflex
 - 3. Metraflex

2.02 IN-LINE EXPANSION COMPENSATORS:

- A. Expansion compensators shall be stainless steel bellows type constructed to protect against torsion, squirm, misalignment, overcompensation and external damage.
- B. The submittal schedule for in-line type expansion compensators shall include the specific location of each and the length of pipe, temperature differential and expansion/contraction length for which the expansion compensator is sized. The following temperature differentials shall be utilized for sizing in-line type expansion compensators:

Type of Pipe	Expansion/Contraction Temperature Differential (Degrees Fahrenheit)
Chilled Water	100
Heating Water	200

2.03 ALIGNMENT GUIDES

- A. Manufacturers: Subject to compliance with requirements, provide alignment guides as manufactured by one of the following:
 - 1. Adscos Manufacturing, LLC.
 - 2. Advanced Thermal Systems, Inc.
 - 3. Engineered Flexible Products
 - 4. Flex-Hose Co., Inc.
 - 5. Flexicraft Industries.
 - 6. Flex-Weld, Inc.
 - 7. Hyspan Precision Products, Inc.
 - 8. Metraflex, Inc.
 - 9. Piping Technology & Products, Inc.
 - 10. Senior Flexonics, Inc.; Pathway Division
- B. Alignment guides shall be constructed of steel, factory fabricated, with bolted two-section outer cylinder and base for alignment of piping and two-section guiding spider for bolting to pipe.

2.04 MATERIALS FOR ANCHORS

- A. Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Stud: Threaded, zinc-coated carbon steel.
 - 2. Expansion Plug: Zinc-coated steel.
 - 3. Washer and Nut: Zinc-coated steel.
- E. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
 - 1. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

2. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
 3. Washer and Nut: Zinc-coated steel.
- F. Concrete: Portland cement mix, 3000 psi minimum. Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
- G. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, 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

3.01 MANUFACTURED LOOP INSTALLATION

- A. Approved Locations:
1. Hydronic Hot Water Piping
 2. Chilled and Glycol Chilled Water Piping
- B. Install manufactured, nonmetallic expansion loops according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
- C. Install expansion joints of sizes matching size of piping in which they are installed.
- D. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.
- E. Install expansion compensators cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

3.02 SWING CONNECTIONS

- A. Connect risers and branch connections to heating water mains with at least five pipe fittings, including tee in main.
- B. Connect risers and branch connections to heating terminal units with at least four pipe fittings, including tee in riser.
- C. Connect mains and branch connections to heating water terminal units with at least four pipe fittings, including tee in main.

3.03 ALIGNMENT-GUIDE INSTALLATION

- A. Install guides on piping adjoining pipe expansion fittings and loops.
- B. Attach guides to pipe and secure to building structure.

3.04 ANCHOR INSTALLATION

- A. 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.
- B. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
- C. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
- D. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints are indicated.
- E. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

END OF SECTION 23 18 22

**SECTION 23 20 10
METAL DUCTWORK**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.
- C. See also Section 23 03 40 for ductwork leakage testing.

1.02 SCOPE

- A. Extent of metal ductwork is indicated on drawings and by requirements of this Section. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
- B. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".
- C. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork. Ductwork shall be sealed and leak tested as required by SMACNA and ASHRAE Standard 90.1.
- D. OMC Compliance: Equipment, materials and installation shall comply with the Ohio Mechanical Code and all requirements of the local authorities having jurisdiction.

1.04 QUALIFICATIONS

- A. Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Special Requirements
 - 1. Submit 1/4" = 1'-0" scale ductwork shop drawings for review, prior to construction. Ductwork shop drawing shall include elevations of the top of duct for each main trunk and major branch, all transitions indicated, all internally lined sections indicated, flexible duct indicated, duct pressure class and duct seal class indicated, and any obstructions that prevent the ductwork from being installed as indicated on the contract documents.
 - a. Do not proceed with ductwork fabrication prior to approval of ductwork shop drawings. All work fabricated or erected prior to receipt of approved ductwork shop drawings is so done at the Contractor's risk and is subject to removal and replacement at no cost to the Owner.
 - b. Upon request, electronic files of ductwork plans in Autocad format may be obtained from the Engineer for development of shop drawings by the sheet metal contractor. A nominal service fee will be charged for processing and email delivery of the files.

- c. Photocopied, reproduced or traced drawings of the original contract documents will not be allowed to be used as ductwork shop drawings. Single line drawings of the ductwork layout will not be allowed to be used as ductwork drawings. Electronic files of the original contract documents will not be allowed to be used as ductwork shop drawings.
 - d. Sheet metal shop drawings shall be submitted separate from coordination drawings.
2. Test and Startup Reports
- a. Ductwork Pressure Test Report (23 03 40) – Where specified
 - b. Balance Report (per section 23 03 30)

1.06 SYSTEM PERFORMANCE REQUIREMENTS

- A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air systems. Changes or alterations to the layout of configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure requirements.
- B. Duct systems shall be leak-tested by the balancing contractor. The sheetmetal contractor shall provide all labor and material (such as temporary caps at terminal boxes), for balancing contractor to accomplish duct leakage testing.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide factory-fabricated ductwork and fittings as manufactured by one of the following:
 - 1. LaPine Metal Products
 - 2. Lindab, Inc.
 - 3. Semco Mfg., Inc.
 - 4. Sheet Metal Connectors, Inc.
 - 5. Spiral Manufacturing Co., Inc.
 - 6. Tangent Air
 - 7. United Sheet Metal Div., United McGill Corp.

2.02 GENERAL

- A. All manufactured ductwork and fittings shall be constructed and rated per the SMACNA pressure classification rating system for the appropriate system type as defined herein.

2.03 MATERIALS

- A. Provide ductwork of materials that are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.
- B. Duct Material Schedule:

SYSTEM DESCRIPTION	DUCT MATERIAL
Supply Air and Return Air	Galvanized Steel
Outside Air and Relief Air	Galvanized Steel
Exhaust Air - General	Galvanized Steel
Combustion Air – Fuel-Burning Appliances	Galvanized Steel

C. Galvanized Steel:

1. Galvanized ductwork shall be fabricated of No. 1 prime galvanized sheet metal of lock forming quality, complying with ASTM A527. Galvanized coating shall comply with ASTM A527 and ASTM A924. Evidence of any separation of galvanized surface from the steel at any point of the ductwork shall be considered sufficient cause to reject this material and work.
2. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts.

2.04 PRESSURE CLASSIFICATIONS

- A. Construct sheetmetal air distribution systems in accordance with the following pressure classifications, as defined in ANSI/SMACNA 006-2006 (3rd Edition). If not indicated below, ductwork shall be constructed to minimum 2" pressure classification:

Editor's Note: Revise system pressure classification descriptions per project

SYSTEM DESCRIPTION	PRESSURE CLASSIFICATION
Supply Air – VAV systems	
Upstream of VAV boxes	6"
Downstream of VAV boxes	2"
Supply – Constant Volume Systems	2"
Return Air (upstream of air handling units)	4"
Return/Transfer Air (plenum return)	2"
Exhaust Air – General	2"
Exhaust Air - Wet	2"
Outside Air	2"
Relief Air (upstream of control dampers)	4"
Relief Air (downstream of control dampers)	2"
Sheetmetal Plenums behind louvers (bottom shall be sloped toward the outdoors)	2"
Make-up Air	2"

2.05 RECTANGULAR DUCT FABRICATION

- A. Fabricate rectangular ducts with galvanized sheet steel in accordance with the latest edition of SMACNA "HVAC Duct Construction Standards", including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications and joint types and intervals.

- B. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification. Preassemble, duct work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for re-assembly and coordinated installation.
- C. Rectangular Fittings Fabrication
 - 1. Changes in direction, of all rectangular supply air ductwork and return air and exhaust air ductwork with any one dimension greater than 10 inches, shall be made with full radius elbows with radius equal to 1-1/2 times the horizontal width of the duct, or with square elbows with turning vanes. Turning vanes shall be constructed of the same material as the surrounding ductwork and two (2) gauge numbers heavier.
 - 2. Branch connections shall be 45 degrees entry or bellmouth-type equivalent. Straight taps, clinch locks, dovetail or spin-in branch connections are not permitted. No excess sheetmetal material shall project from the main duct into branch entry taps.

2.06 ROUND AND FLAT OVAL DUCTWORK FABRICATION

- A. Round and Flat-Oval Ducts: Fabricate round and flat-oval ducts of SMACNA 2" and 3" W.G. pressure classification with spiral seam, grooved seam or snaplock seam construction. Fabricate round and flat-oval ducts of 4", 6" and 10" W.G. pressure classification with spiral lock-seam construction or fusion-welded butt seam for longitudinal seam duct. Comply with the latest edition of SMACNA "HVAC Duct Construction Standards", for galvanized steel gauges.
- B. Round and Flat Oval Fittings Fabrication
 - 1. All laterals, reducers, tees and elbows shall be continuously welded along all seams.
 - 2. All 45° laterals, 90° branches and tees shall be made with conical or bellmouth fittings. All conical laterals, branches and tees shall be fabricated to conform to the latest edition of SMACNA "HVAC Duct Construction Standards" with metal thicknesses specified for longitudinal seam straight duct.
 - 3. All diverging -flow fittings shall be fabricated with a reduced entrance to branch taps with no excess material projecting from the body into ranch tap entrance. Straight taps, clinch locks, dovetail or spin-in branch connections are not permitted.
 - 4. All laterals, reducers, tees and elbows for ducts of 4", 6" and 10" W.G. pressure classification shall be continuously welded along all seams.
 - 5. For 2" and 3" w.g. pressure class ductwork, elbows may be adjustable or segmented standing seam with a bend radius of 1.5 times the duct diameter and a maximum 20 degree per section (gore). Apply duct sealant to the interior seams of these elbows.
 - 6. Fabricate elbows for ductwork of 4", 6" and 10" w.g. pressure class construction in stamped or 5-gored, segmented construction. Segmented elbows shall have each transverse gore continuously welded. Apply sealant to the interior seams of these elbows. Fabricate the bend radius of stamped or 5-gored elbows 1.5 times the duct diameter. Segmented elbows shall not exceed 20 degree change of direction per section (gore).

2.07 HANGERS AND SUPPORTS

- A. Building attachments shall be concrete inserts or structural steel fasteners appropriate for building materials. Do not use power actuated concrete fasteners without express written consent of Owner. Do not use power actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4" thick. "C" type beam clamps may be utilized only with beam retaining straps.
- B. Hangers shall be galvanized sheet steel, or round, uncoated steel, with straps and threaded rod sized per SMACNA.

- C. Duct attachments shall be made using sheet metal screws, blind rivets or self-tapping metal screws; compatible with duct materials.
- D. Support Materials: Provide hot-dipped galvanized steel shapes and plates for galvanized steel ducts.
- E. All adhesive hangers shall be approved for use with cracked concrete per the American Concrete Institute and ICC-ES Standard AC308. All mechanical hangers shall be approved for use with cracked concrete per the American Concrete Institute and ICC-ES Standard AC193.

2.08 JOINT SEALANT

- A. Acceptable manufacturers: Subject to compliance with requirements, provide ductwork sealing materials as manufactured by one of the following:
 - 1. Monoco Industries
 - 2. 3M
 - 3. United Sheet Metal.
 - 4. Ductmate Industries, Inc.
- B. Joint and seam sealant shall be LEED compliant, water-based, have a synthetic latex emulsion base, and comply with UL 181B-M and UL 723.
- C. Joint and seam sealing materials shall be non-hardening, non-migrating mastic or liquid elastic, suitable for use with air distribution ductwork.
- D. Oil based sealing compounds are not acceptable.

2.09 SURFACE PRE-TREATMENT AND FINISH

- A. Where ductwork is to be finish painted in exposed locations, galvanized sheet metal shall be pre-etched type known as "Galvanneal" or "Paint-Grip".
- B. Final paint color selection shall be per the Architect, unless noted otherwise.

2.10 MISCELLANEOUS SHEETMETAL

- A. Auxiliary (secondary) Drain Pans
 - 1. Fabricate from 18 gauge 304 stainless steel.
 - 2. Exposed sheetmetal edges shall be rolled over to provide a rounded edge for safety of building maintenance personnel.
 - 3. Slope drain pan bottom to drain piping connection location.
 - 4. Weld all seams for water-tight joint.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide all ductwork as indicated on the drawings, making all necessary offsets (whether or not specifically indicated) as required to meet the various building conditions. Ductwork installation shall not conflict with equipment or piping.
- B. All changes in cross section shall be made without reducing the design area of the duct.
- C. No pipe or other obstructions shall pass through air ducts.
- D. Cover exposed ductwork openings with visqueen or duct sock type cap to keep inside of ductwork free of dust, debris, etc. during construction.
- E. Ductwork shall be hung from structure; ductwork shall not be hung from equipment, piping, conduit or other ductwork.
- F. Provide all manual balancing dampers where indicated on the drawings and where necessary to properly distribute and balance the air.
- G. Provide flexible duct connections at all fan inlets and outlets.

- H. All ductwork joints and seams shall be air-tight. Poorly made joints, splits, visible holes at corners, etc. shall be reworked and repaired. Where excessive pulsating of ductwork is found, additional stiffeners shall be added. Any cracking in the sealant that is apparent upon inspection shall be sufficient to warrant rejection.
- I. If the interior of sheet metal is exposed to view through air distribution devices in finished areas of the building, it shall be coated with primer and a flat black finish coat.

3.02 INSTALLATION

- A. Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards. Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight and noiseless systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth.
- B. Install ductwork runs above ceilings so as to maintain design ceiling heights. Exposed ductwork shall be installed to provide maximum headroom.
- C. All ductwork shall be supported per SMACNA requirements.
- D. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor. Install couplings tight to duct surface with projections into duct at connections kept to a minimum.
- E. Complete field fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- F. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns and other structural and permanent enclosure elements of building. Limit clearance to 1" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- G. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2".
- H. Coordinate duct installation with installation of accessories, fans, dampers, coil frames, equipment, controls and other associated work of ductwork system.

3.03 HANGING AND SUPPORTING

- A. Install rigid round and rectangular metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards", Tables 4-1 through 4-3 and Figures 4-1 through 4-8.
- B. Support horizontal ducts with 2 feet of each elbow and within 4 feet of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
- D. Upper attachments to structures shall have an allowable load not exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated.
- E. Install concrete insert prior to placing concrete.

3.04 DUCTWORK SEALING REQUIREMENTS

- A. Duct sealant shall be furnished and installed in accordance with SMACNA Standards at an application temperature between 35° F to 110° F.
- B. All ductwork shall be sealed per SMACNA Standards:

Table 23 20 10.1

Duct Class	Seal Class	Sealing Applicable
1/2-, 1-, 2-in wg	C	Transverse Joints Only
3-in wg	B	Transverse Joints and Seams
4-, 6-, 10-in wg	A	Joints, Seams and All Wall Penetrations

- C. Seal and pressure test externally insulated ducts prior to insulation installation with two coats of sealant.
- D. Helical (spiral) lock seams do not have to be sealed.
- E. Return air boots are not required to be sealed.
- F. Longitudinal seams of all outdoor ducts shall be on the bottom of the ducts and the ducts shall be sealed water tight.

3.05 ADJUSTING, CLEANING, AND PAINTING

- A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal.
- B. At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for air distribution testing and balancing of metal ductwork; not work of this Section. Seal any leaks in ductwork that become apparent in duct leakage tests or balancing process.
- D. Exterior, uninsulated ducts shall be painted.

3.06 DUCT MOUNTED SMOKE DETECTOR INSTALLATION

- A. Not applicable.

END OF SECTION 23 20 10

**SECTION 23 20 50
BREECHINGS AND VENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.
- C. Related Sections: Refer to other Sections of Division 23 for insulation of breechings.

1.02 SUMMARY

- A. This Section specifies vents and breechings for fuel burning appliances and includes materials and installation requirements. Extent of work required by this Section is indicated on drawings and by requirements of this Section.
- B. This Section specifies single wall metal vents and accessories for gas-fired appliances.
- C. This Section specifies double wall metal vents and accessories for gas-fired appliances.
- D. This Section specifies single wall, positive pressure vents and accessories for gas-fired appliances.
- E. This Section specifies double wall, positive pressure vents and accessories for gas-fired appliances.
- F. This Section specifies field fabricated metal breechings.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. NFPA: Comply with NFPA 211 "Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances."
 - 2. UL: Comply with appliances portions of UL safety standards; provide products which have been UL listed and labeled.
 - 3. SMACNA: Comply with SMACNA Duct Construction Standards for fabricated breechings and smokepipe.
 - 4. AWS: Comply with AWS Structural Welding Code for welders' qualifications, welding details, and workmanship standards.
 - 5. ASHRAE: Comply with the ASHRAE Equipment Handbook, Chapter 6, for Chimney, Gas Vent, and Fireplace Systems, material requirements and design criteria.
 - 6. National Fuel Gas Code: Comply with National Fuel Gas code for gas vents and breechings.
- B. Materials and installation shall comply with the appliance manufacturer's written venting guides and installation manuals, Local Mechanical Code and all requirements of the local authorities having jurisdiction.
- C. Welders Qualifications: All welders shall be certified in accordance with AWS Standard D9.1, Specifications for Welding Sheet Metal.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 MATERIAL SCHEDULE

- A. The table below identifies the acceptable breeching and vent materials allowed for this project. Where multiple options are listed, the option used shall be at the discretion of the Contractor.

Description	Material
Boiler Flue Vent	Factory Fabricated Positive Pressure Double Wall Metal Vents (AL-29-4C, type 444 SS or type 316L SS inner liner) (note: vent material must be approved by boiler manufacturer, only AL-29-4C is approved by Aerco)
Domestic Water Heater Flue Vent	Factory Fabricated Positive Pressure Single Wall Metal Vents with field applied insulation
	Factory Fabricated Positive Pressure Double Wall Metal Vents (AL-29-4C, type 444 SS or type 316L SS inner liner) (note: vent material must be approved by domestic water heater manufacturer, only AL-29-4C is approved by Aerco)
Combustion Air	Metal Ductwork (section 23 20 10)
	PVC pipe (as allowed by the appliance manufacturer)

2.02 FACTORY FABRICATED POSITIVE PRESSURE DOUBLE-WALL METAL VENTS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following:
1. Jeremias Exhaust Systems (**not approved by Aerco**)
 2. Metal-Fab Inc.
 3. Pro-Tech Systems, Inc./DuraVent (M&G Group)
 4. Schebler Co.
 5. Security Chimneys International
 6. Selkirk Metalbestos
- B. Vents shall be UL listed double wall, factory built metal vents for use with approved Category III appliances burning gaseous or liquid fuels.
- C. Vents shall be constructed of an outer wall of aluminized steel, an integral annular air space and an inner wall of type 304 stainless steel.
- D. Where indicated on the drawings, the annular space shall be filled with insulation.
- E. All inner pipe joints shall be held together by means of formed vee bands and sealant as specified in the manufacturer's recommendations.
- F. All roof penetrations, terminations, appliance adapters, thimbles drain fittings, expansion joints, etc. required for a complete installation shall be included and furnished by the manufacturer.

PART 3 EXECUTION

3.01 GENERAL

- A. Store delivered materials inside, out of the weather. Protect materials from accidental damage.
- B. Installation shall conform to the manufacturer's installation instructions, UL listing (where applicable) and state and local codes.
- C. Furnish breechings and vents per the table in Part 2.

3.02 VENT SYSTEM LAYOUT

- A. The vent system shall be routed to maintain minimum clearance to combustibles as specified by the manufacturer.
- B. Vent Installation shall conform to the manufacturer's installation instructions, its UL listing and state/local codes.
- C. The vent system and breechings shall be inspected and cleaned before the final connection to the appliances.

3.03 METAL VENTS AND BREECHINGS

- A. Support all metal vents from building structure by welding, bolting, steel expansion anchors, or concrete inserts per manufacturer's installation instructions. Size of structural shapes shall be in accordance with manufacturer's recommendations.
- B. Cap all open ends of metal vents during construction to prevent entrance of dust, debris, etc.
- C. Clean all metal vents of dust and debris prior to final connection to appliances.
- D. Roof penetrations shall be made with manufacturer's factory fabricated terminations.
- E. For condensing boilers and appliances, pipe all low points and the bottom of vertical risers to condensate neutralizer.

END OF SECTION 23 20 50

**SECTION 23 21 10
EXTERNAL DUCT INSULATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.
- C. Interior ductliner insulation is specified in other Division 23 Specifications.

1.02 SCOPE

- A. This Section specifies duct insulation materials and installation methods common to more than one section of Division 23.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all insulation work described in this Section.

1.03 CODES AND STANDARDS

- A. Provide all insulation materials (insulation, jackets, fitting covers, adhesives, cements, mastics, sealers and finishes) with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

1.04 QUALITY ASSURANCE

- A. Installing contractor shall have at least 3 years successful installation experience on projects with mechanical insulation similar to that required for this project.
- B. Insulation thickness shall meet the requirements of ASHRAE Standard 90.1.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Unless otherwise noted, and subject to compliance with Specifications, provide insulation materials from the manufacturers specified below:
 - 1. Fiberglass Wrap
 - a. Johns Manville
 - b. Knauf Insulation
 - c. Manson Insulation
 - d. Owens Corning
 - 2. Rigid Fiberglass
 - a. Johns Manville
 - b. Knauf Insulation
 - c. Manson Insulation
 - d. Owens Corning
 - 3. Jacketing System
 - a. Venture Clad ® 1577CW-WE – Manufactured by Venture Tape Corp

- b. Flexclad 400 – Manufactured by MFM Building Products

2.02 GENERAL

- A. Provide all insulation materials (insulation, jackets, fitting covers, adhesives, cements, mastics, sealers and finishes) with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

2.03 FIBERGLASS WRAP

- A. Fiberglass ductwrap shall have a density of 1.0 lbs per cubic foot.
- B. Fiberglass ductwrap shall have an foil-scrim-kraft (FSK) jacket.
- C. Install fiberglass ductwrap per the following insulation schedule:

Table 23 21 10.1

Ductwork Insulation Schedule (Fiberglass Duct Wrap)	
Duct Type	Insulation Thickness
Concealed Supply Air (including sound attenuators, diffuser plenums, downstream of heat pumps, and outside ventilation air from energy recovery units)	2"
Combustion Air	
Concealed Outside Air	
Concealed Mixed Air	
Concealed Relief Air (between plenum/louver and the relief air control/ back draft damper)	

2.04 RIGID FIBERGLASS

- A. Rigid fiberglass insulation shall have a density of 3.0 lbs per cubic foot.
- B. Rigid fiberglass insulation shall comply with ASTM C 612, Type IA or Type IB.
- C. Rigid fiberglass insulation shall have an all service jacket.
- D. Install rigid fiberglass insulation per the following insulation schedule:

Table 23 21 10.2

Ductwork Insulation Schedule (Rigid Fiberglass)	
Duct Type	Insulation Thickness
Exposed Supply Air (in non-air conditioned spaces)	2"
Exposed Return Air (in non-air conditioned spaces)	
Supply Air (within mechanical rooms)	
Return Air (within mechanical rooms)	
Exposed Outside Air (in non-air conditioned spaces)	
Exposed Mixed Air (in non-air conditioned spaces)	
Outside Air (within mechanical rooms)	
Mixed Air (within mechanical rooms)	

Ductwork Insulation Schedule (Rigid Fiberglass)	
Duct Type	Insulation Thickness
Exposed Relief Air (in non-air conditioned spaces between the plenum/louver and the relief air control/back draft damper)	3"
Relief Air (within mechanical rooms between the plenum/louver and the relief air control/back draft damper)	
Supply Air (exterior)	
Return Air (exterior)	
Exhaust Air (exterior)	

2.05 JACKETING SYSTEM

- A. In addition to the specified insulation, all exterior ductwork shall be covered with a prefabricated self-adhering, sheet-type waterproofing membrane. The membrane shall be UV-resistant, exceed a 25/50 flame/smoke rating, and be designed specifically for exterior use.
- B. The entire jacketing system shall be rated specifically for exterior use.
- C. Provide jacketing system with a white/white embossed finish.
- D. Follow manufacturer's recommended installation instructions.
- E. Acceptable waterproofing membrane products: Flexclad 400 manufactured by MFM Building Products Corp., VentruClad 1577 CW manufactured by Venture Tape Corp.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Maintain integrity of vapor-barrier on ductwork insulation.
- B. Install ductwork insulation continuous through all wall, floor and ceiling penetrations, except at fire and/or smoke damper locations.
- C. Impale rigid duct insulation over welded pins at maximum of 12 inches on center and secure with self-locking caps. Seal all insulation edges and butt joints firmly with 5 inch wide pressure sensitive joint sealing tape.
- D. Wrap faced duct wrap insulation tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2 inches. Adhere insulation to metal with 4 inch strips of insulation bonding adhesive at 8 inches on center. Additionally secure insulation to the bottom of rectangular ductwork over 24 inches wide with mechanical fasteners at not more than 18 inches on center. Secure facing for circumferential and longitudinal joints using reinforced Kraft tape. Tape all pin penetrations or punctures in facing.
- E. Except on supply and return air ductwork installed outside and as otherwise noted, omit exterior duct insulation where internal duct lining is installed.

3.02 DELIVERY, STORAGE, HANDLING

- A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.
- C. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

- D. The insulation installer shall advise the General Contractor as to requirements for protection of the insulation work during the remainder of the construction period (after the installation of insulation), to avoid damage and deterioration of the finished insulation work.

3.03 JACKETING SYSTEM

- A. Furnish duct jacketing system for all ductwork installed outdoors.
- B. Jacketing system shall be installed to provide a weather proof protective membrane. Install jacket on all duct surfaces and overlap joints to promote water shedding.

END OF SECTION 23 21 10

**SECTION 23 22 10
GRILLES AND DIFFUSERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies air distribution equipment and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All ductwork shall be constructed and installed per the following requirements:
 - 1. SMACNA "HVAC Duct Construction Standards, Metal and Flexible"
 - 2. ASHRAE standards for duct construction.
- B. Equipment, materials and installation shall comply with the applicable Mechanical Code and all requirements of the local authorities having jurisdiction.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Titus
 - 2. Krueger
 - 3. Price

2.02 GENERAL

- A. Provide grilles and diffusers where shown on the drawings, of size, type and material as indicated by model numbers in the schedules and as required for a complete installation.
- B. Border types shall be compatible with the ceilings, walls, and floors where the grilles and diffusers are to be installed.
- C. Where necessary for proper installation, provide plaster frame for installation of diffusers in plaster or drywall ceilings. Furnish with mounting system allowing no exposed fasteners.
- D. Refer to Architectural Drawings for exact location of grilles and diffusers.
- E. Performance
 - 1. Unless noted otherwise on the drawings, grilles and diffusers shall not exceed a noise criteria of NC 25 at their design operating maximum airflow.

2.03 STAMPED METAL GRILLES

- A. Construction

1. Construct of steel
 2. Orient blades parallel to long dimension for ceiling applications, orient parallel with floor for wall mounted applications.
- B. Finish
1. All stamped metal grilles and diffusers shall be finished with a custom color, factory applied powder coat finish, unless noted otherwise on the drawings. Color selection shall be as scheduled.

2.04 SUPPLY AIR DIFFUSER PLENUMS

- A. Construction
1. Zinc coated steel with ½" thick fiber free foam insulation. Plenums shall be oversized to maintain open free area inside plenum.

PART 3 EXECUTION

3.01 GENERAL

- A. All grilles and diffusers shall be supported per SMACNA requirements.
- B. Install all equipment as indicated on the drawings and in accordance with the manufacturer's installation instructions. Refer to Architectural Drawings for exact location of grilles and diffusers.
- C. Mechanical Contractor shall locate all grille and diffuser positions and dimensions and coordinate requirements with the General Contractor. The Mechanical Contractor shall install grilles and diffusers.

3.02 ADJUSTING AND CLEANING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.
- B. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 22 10

**SECTION 23 22 20
DUCTWORK ACCESS DOORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies ductwork access doors and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All ductwork shall be constructed and installed per the following requirements:
 - 1. SMACNA "HVAC Duct Construction Standards, Metal and Flexible"
 - 2. ASHRAE standards for duct construction.
- B. Equipment, materials and installation shall comply with the Local Mechanical Code and all requirements of the local authorities having jurisdiction.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Air Balance, Inc.
 - 2. Diro Dyne Corp.
 - 3. Ruskin Mfg. Co.
 - 4. Ventfabrics, Inc.
 - 5. Zurn Industries, Inc.; Air Systems Div.

2.02 CONSTRUCTION

- A. Construct access doors of same or greater gauge as ductwork served. Access doors shall be rated for the duct pressure classification in which they are installed. Provide flush frames for uninsulated ductwork; extended frames for externally insulated duct (same thickness as insulation).
- B. Access doors shall be provided with a gasket and shall be completely removable by the use of two or more cam lock type latches.
- C. Minimum size of access doors shall be 2" less than width or height of duct (at location where access door is installed) by 18" in length up to a maximum of 18" x 24".
- D. Where ductwork is externally insulated or internally lined, access doors shall be double wall (metal construction) with insulation.

- E. Access doors shall be provided with wire reinforced glass window where indicated on drawings.
- F. Access doors shall comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible". Pressure rating shall meet or exceed pressure classification of ductwork.

2.03 LINING

PART 3 EXECUTION

3.01 GENERAL

- A. Provide all duct accessories as indicated on the drawings. Duct accessories installation shall not conflict with equipment or piping.
- B. All air distribution equipment shall be supported per SMACNA requirements.
- C. Install all equipment as indicated on the drawings and in accordance with the manufacturer's installation instructions.

3.02 INSTALLATION

- A. Install duct access doors at all fire damper, smoke damper, and combination fire/smoke damper locations for fusible link repair. Install duct access doors at all balancing damper locations for balancing dampers greater than 18" in any dimension and having linkage internal to ductwork.
- B. Install duct access doors at upstream side of all reheat coils.
- C. Locate duct access doors for easiest accessibility to fire dampers and coils. Coordinate locations, and sizes of drywall ceiling access doors and shaft access doors (provided by General Trades) to line-up with duct access doors.

3.03 ADJUSTING AND CLEANING

- A. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 22 20

**SECTION 23 22 30
MANUAL BALANCE DAMPERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies ductwork and air distribution equipment and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All ductwork shall be constructed and installed per the following requirements:
 - 1. SMACNA "HVAC Duct Construction Standards, Metal and Flexible"
 - 2. ASHRAE standards for duct construction.
 - 3. AMCA Standard 500-D.
- B. Equipment, materials and installation shall comply with the Local Mechanical Code and all requirements of the local authorities having jurisdiction.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 BALANCING DAMPERS

- A. Acceptable Manufacturers
 - 1. Air Balance, Inc.
 - 2. American Warming and Ventilating, Inc.
 - 3. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
 - 4. Greenheck
 - 5. Metropolitan Air Technology
 - 6. Ruskin
 - 7. Tamco
- B. Round dampers shall consist of:
 - 1. Single-blade type construction.
 - 2. Minimum 18 gauge galvanized steel.
 - 3. Suitable for the ductwork pressure classification in which they are installed.
 - 4. Pivot rod shaft shall be continuous through cross section of duct.

5. Furnish all round balancing dampers with Young Regulator Company 403, 403B, 443 or 443B series Valcalox regulators with handle permanently attached. Damper handle position shall be securely locked in place by tightening of a lock nut. Where ductwork is externally insulated, regulator base height shall accommodate insulation thickness (Young Regulator Company 443 or 443B series Valcalox regulators). Regulator shall be clearly marked to indicate damper position
- C. Rectangular dampers 8"x8" and smaller shall be single blade; dampers larger than 8"x8" shall be multi-blade (opposed blade) type. Dampers shall consist of:
 1. 16 gauge galvanized steel hat channel frame with 5" depth.
 2. Triple V-type blades fabricated from 16 gauge galvanized steel.
 3. 1/2" diameter plated steel axles.
 4. External (out of airstream) blade-to-blade linkage.
 5. Dampers shall be suitable for the ductwork pressure classification in which they are installed.
 6. Furnish with standard 1-1/2" standoff bracket (optional 2" standoff bracket where ductwork is externally insulated, regulator base height shall accommodate insulation thickness) and 1/2" locking manual quadrant with handle permanently attached. Damper handle position shall be securely locked in place by tightening of a lock nut. Regulator shall be clearly marked to indicate damper position.
 - D. Seals shall be provided on all balancing dampers installed in 3 inch water column pressure class ductwork and higher.
 - E. All balancing dampers shall be constructed in accordance with SMACNA "HVAC Duct Construction standards".

PART 3 EXECUTION

3.01 GENERAL

- A. Provide all duct accessories as indicated on the drawings. Duct accessories installation shall not conflict with equipment or piping.
- B. Provide all manual balancing dampers where indicated on the drawings and where necessary to properly distribute and balance the air.
- C. All air distribution equipment shall be supported per SMACNA requirements.
- D. Install all equipment as indicated on the drawings and in accordance with the manufacturer's installation instructions.

3.02 ADJUSTING AND CLEANING

- A. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 22 30

**SECTION 23 22 40
FIRE DAMPERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies fire dampers and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. Dampers shall be UL labeled according to UL Standard 555 "Standard for Fire Dampers".
- B. All ductwork mounted devices shall be constructed, certified and installed per the following requirements:
 - 1. AMCA 500 – Test Methods for Louvers, Dampers and Shutters
 - 2. AMCA 500D – Laboratory Methods for Testing Dampers for Ratings
 - 3. AMCA 511 – Certified Ratings Program for Air Control Devices
 - 4. ASHRAE standards for duct construction.
 - 5. ICC – International Code Council
 - 6. NFPA 80 – Fire Doors & Other Opening Protectives
 - 7. NFPA 90A – Installation of Air Conditioning and Ventilating Systems
 - 8. NFPA 101 – Life Safety Code
 - 9. NFPA 105 – Standards for Smoke Door Assemblies and Other Opening Protectives
 - 10. SMACNA – (Fifth Edition) Fire, Smoke, and Radiation Damper Guide for HVAC Systems
 - 11. UL 555 – (Seventh Edition) Standard for Safety; Fire Dampers

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Product Data: For each damper include:
 - 1. UL Ratings for fire resistance, leakage, velocity, differential pressure and elevated temperature.
 - 2. UL Installation instructions.
 - 3. Installation Methods.
 - 4. Indicate materials, construction, dimensions, and installation details.
 - 5. Verify conformance to NFPA, UL, MEA, CSFM and applicable building codes.
 - 6. Include damper pressure drop data for all sizes based on tests and procedures performed in accordance with AMCA 500-D.

7. Preparation instructions and recommendations.
8. Storage and handling requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications
 1. Manufacturer shall be International Organization for Standardization (ISO) 9001 accredited.
- B. Product Qualifications
 1. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA 500 and certified by AMCA (if applicable).
 2. Dampers shall meet requirements for fire dampers in accordance:
 - a. NFPA 80, 90A, 92A, 92B, and 101
 - b. CSFM – 3235: Fire Damper Listing
 - c. Applicable Building Codes
 3. Dampers shall be tested, rated, and labeled in accordance with:
 - a. UL 555 (Seventh Edition), Listing R5531
 4. Dampers shall be factory engineered to withstand the specified seismic loads
 - a. Minimum design loads shall be calculated to comply with ASCE-7, or local requirements of Authority Having Jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer, material, and location of installation.
- B. Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.
- C. Protect materials and finishes during handling and installation to prevent damage.

1.07 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 SOURCE QUALITY CONTROL

- A. Factory Tests: factory cycle damper assembly to assure proper operation.

1.09 WARRANTY

- A. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide fire dampers as manufactured by one of the following:
 1. Greenheck
 2. Ruskin
 3. American Warming and Ventilating

2.02 FIRE RESISTANCE CAPABILITY

- A. Dampers shall have a minimum damper rating of 1-1/2 hours for installation in less than 3 hour fire resistance rated assemblies.
- B. Dampers shall have a minimum damper rating of 3 hours for installation in 3 hour or greater fire resistance rated assemblies.
- C. Fusible link shall be replaceable, rated at 165°F unless noted otherwise.

2.03 DAMPER CONSTRUCTION

- A. Fire dampers shall be curtain-type rated for use in dynamic systems with stainless steel closure spring that shall close against the maximum calculated airflow of that portion of the air duct system in which they are installed.
- B. Frame shall be Type A, B, or C (round or oval as required) as indicated on the drawings; minimum 20 gauge galvanized steel, with mitered and interlocking corners. Frames and dampers in wet air exhaust shall be stainless steel.
- C. Mounting sleeves shall be factory installed or field installed galvanized steel as detailed on the drawings.
 - 1. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of the wall or floor, and thickness of damper frame meets sleeve requirements.
- D. Mounting orientation shall be vertical or horizontal as indicated on the drawings.
- E. Blades shall be roll-formed, interlocking, 20 gauge galvanized steel. In place of interlocking blades, provide full length, 20 gauge galvanized steel blade connectors.

2.04 DAMPER CONSTRUCTION

- A. Fire Dampers shall be single blade type rated for use in Dynamic Systems. Dampers shall be rated up to a maximum 4000 fpm velocity and 4" wg differential pressure. Dampers may be mounted vertical or horizontal as indicated on drawings.
- B. Frame: Dampers shall be constructed using an integral sleeve and frame 20 gauge galvanized steel, single piece. All square or rectangular damper frames shall be roll form constructed using one-piece uni-frame construction and reinforced at each corner to ensure the best structural integrity and reduced racking prior to installation.
 - 1. Blade: Damper blade shall be low-profile, aerodynamic shape, double skin 16 and 20 gauge galvanized steel.
 - 2. If blade stops are utilized, the blade stops shall not exceed more than 1/2 inch in height to maximize free area and to minimize pressure loss across the damper. (Blade stops at the top and bottom of the damper frame, are not required to meet UL555 listings).
 - 3. Shaft shall be minimum 1/2 in hex-shaped plated steel, mechanically attached to blade.
 - 4. Bearings: Shaft bearings shall be self-lubricating stainless steel sleeve type, rotating in extruded holes in the damper frame.
 - 5. Factory Sleeve Damper shall be constructed using an integral, 20 gauge galvanized steel sleeve.
 - 6. Mounting Angle: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with manufacturer's UL listing:
- C. Accessories
 - 1. Indicator or Auxiliary Switch Packages:
 - a. Breakaway Duct Connections shall be compatible with Ductmate, TDF, or TDC as required by the sheetmetal contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect areas where dampers are to be received. Notify the Architect/Engineer of conditions that would adversely affect the installation or subsequent utilization of dampers. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Install dampers in accordance with manufacturer's UL Installation Instructions, product labeling, and NFPA 90A at locations indicated in the drawings. Any damper installation that is not in accordance with the manufacturer's UL Installation Instructions shall be approved prior to installation.
- B. Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, jackshaft or any other accessory supplied on the damper.
- C. Install dampers square and free from racking.
- D. Do not stretch the damper frame into the duct or opening.
- E. All dampers shall be secured and supported per SMACNA requirements.
- F. Dampers installation shall not conflict with equipment or piping.
- G. The installing contractor shall provide and install bracing for multiple section assemblies to support the assembly weight and to hold against system pressure.
- H. Attach multiple damper section assemblies together in accordance with manufacturer's instructions.
- I. Dampers shall be accessible to facilitate code-required inspection, adjustment, and like for like replacement of components.
- J. Division 23 Contractor shall locate all fire damper positions and dimensions and coordinate access requirements with the General Contractor. The Division 23 Contractor shall install all dampers.
- K. Contractor shall coordinate post installation inspection and cycle test of each damper as required by IFC, NFPA, and local codes. Final inspection and test report shall be furnished to building Owner for records.

3.03 CONNECTIONS

- A. Furnish dampers with inlet and discharge duct connection flanges of construction appropriate to the pressure classification of the duct system in which the damper is installed.

3.04 DUCT ACCESS DOORS

- A. Install duct access doors at all damper locations for fusible link repair.
- B. Locate duct access doors for easiest accessibility to dampers.
- C. Coordinate locations, and sizes of drywall ceiling access doors and shaft access doors (provided by General Trades) to align with duct access doors.

3.05 DEMONSTRATION

- A. Demonstrate to the Owner's Representative the fire damper is accessible, operates properly and fusible link is easily replaced.

END OF SECTION 23 22 40

**SECTION 23 22 60
COMBINATION FIRE AND SMOKE DAMPERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies combination fire and smoke dampers and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All ductwork shall be constructed and installed per the following requirements:
 - 1. SMACNA "HVAC Duct Construction Standards, Metal and Flexible"
 - 2. ASHRAE standards for duct construction.
- B. Equipment, materials and installation shall comply with the Local Mechanical Code and all requirements of the local authorities having jurisdiction.
- C. Combination fire/smoke dampers shall be UL labeled according to UL Standard 555S, "Standard for Leakage Rated Dampers for Use in Smoke Control Systems".
- D. Combination fire/smoke dampers shall also be UL labeled according to UL Standard 555 "Standard for Fire Dampers".
- E. Dampers shall be rated for use in dynamic systems and shall close against the maximum calculated airflow of that portion of the air duct system in which they are installed.
- F. Actuators shall be listed according to ISO standard 9001, UL standard 873, or UL standard 60730.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide combination fire and smoke dampers as manufactured by one of the following:
 - 1. Greenheck Fan Co.
 - 2. Air Balance, Inc.
 - 3. American Warming & Ventilating, Inc.
 - 4. Nailor-Hart Industries, Inc.
 - 5. National Controlled Air
 - 6. Ruskin Mfg. Co.

2.02 GENERAL

- A. Provide UL approved and labeled combination fire/smoke dampers in all ductwork and air handling units where shown on the drawings and/or where required by NFPA Standard 90A. Each combination fire/smoke damper shall be classified by Underwriters' Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bears a UL label attesting to same.
- B. Damper manufacturer shall have tested and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. The leakage rating under UL555S shall be Leakage Class 1 (4 cfm/ft. at 1" w.g.) for combination fire/smoke dampers installed in oval and round ductwork. Combination fire/smoke dampers with airfoil shaped blades shall be utilized in all oval and round ductwork. Combination fire/smoke dampers of single thickness blades shall be Leakage Class 2 (10 cfm/ft. at 1" w.g.) and shall be utilized in all rectangular ductwork.
- C. Dampers shall have a minimum damper rating of 1-1/2 hours for installation in less than 3 hour fire resistance rated assemblies.
- D. Dampers shall have a minimum damper rating of 3 hours for installation in 3 hour or greater fire resistance rated assemblies.
- E. Fusible link shall be replaceable, rated at 165°F unless noted otherwise.
- F. Provide jack shafting on multi-section dampers.

2.03 DAMPER CONSTRUCTION

- A. Provide each damper with two position indicator switches linked directly to damper blade to remotely indicate damper blade position.
- B. Combination fire/smoke dampers for round and oval ductwork shall have minimum 20 gauge galvanized steel frame and minimum 14 gauge galvanized steel blades. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Blade edge seal shall be silicone rubber designed to withstand 450°F and fully encompassing blade edge. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close) under HVAC system operating conditions with pressure of at least 4" w.g. in the closed position, and 3,500 fpm air velocity in the open position.
- C. Combination fire/smoke dampers installed in rectangular ductwork, of SMACNA 2" w.g. pressure classification and less, shall be parallel blade with minimum 16 gauge formed galvanized steel frame and single thickness, minimum 16 gauge galvanized steel blades. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber designed to withstand 450°F and jamb seal shall be stainless steel flexible metal compression type. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close) under HVAC system operating conditions with pressure of at least 4" w.g. in the closed position, and 2,000 fpm air velocity in the open position.
- D. Combination fire/smoke dampers installed in rectangular ductwork, of SMACNA 3" w.g. pressure classification and greater, shall be parallel blade with minimum 16 gauge formed galvanized steel frame and minimum 14 gauge airfoil shaped double skin blades. Bearings shall be stainless steel sleeve turning in an extruded hole in frame. Blade edge seals shall be silicone rubber designed to withstand 450°F and jamb seal shall be stainless steel flexible metal compression type. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close) under HVAC system operating conditions with pressures of at least 4" w.g. in the closed position, and 4,000 fpm air velocity in the open position.

2.04 ACTUATORS:

- A. In addition to the leakage ratings already specified herein, the smoke dampers and their actuators shall be qualified under UL555S to an elevated temperature of 250°F, 350°F, or 450°F depending upon the actuator.

- B. Damper and actuator shall be supplied as a single entity which meets all applicable UL555S qualifications for both dampers and actuators. Damper and actuator assembly shall be factory cycled 10 times to assure operation.
- C. Unless noted otherwise, Electric 120 V.A.C. actuators shall be installed by the damper manufacturer at time of damper fabrication to assure proper operation.

2.05 DUCT MOUNTED SMOKE DETECTORS

- A. Smoke detectors are furnished under another division of these specifications.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide combination fire and smoke dampers as indicated on the drawings.
- B. Combination fire and smoke dampers installation shall not conflict with equipment or piping.
- C. All combination fire/smoke dampers shall be secured and supported per SMACNA requirements.
- D. Install all equipment as indicated on the drawings and in accordance with the manufacturer's installation instructions.
- E. Mechanical Contractor shall locate all combination fire and smoke dampers positions and dimensions and coordinate requirements with the General Contractor.
- F. The Mechanical Contractor shall install combination fire and smoke dampers.
- G. Install dampers square and not racked.
- H. Locations where ductwork is smaller than the minimum size required for smoke detectors, (8" x 8"), the Mechanical Contractor shall increase the size of the ductwork to accommodate the smoke damper and detector.

3.02 CONNECTIONS

- A. Furnish dampers with duct connection flanges

3.03 DUCT ACCESS DOORS

- A. Install duct access doors at combination fire/smoke damper locations for fusible link repair.
- B. Locate duct access doors for easiest accessibility to combination fire/smoke dampers.
- C. Coordinate locations, and sizes of drywall ceiling access doors and shaft access doors (provided by General Trades) to align with duct access doors.

3.04 DEMONSTRATION

- A. Demonstrate to the Owner's Representative that each damper is accessible and is easily closed when fusible link is removed and motor activated.

3.05 DUCT MOUNTED SMOKE DETECTORS

- A. Shall be provided and wired by the Electrical Contractor and mounted in the duct by the Mechanical Contractor.
- B. The Mechanical Contractor shall be responsible for adjusting ductwork sizes to accommodate installation requirements of duct mounted smoke detectors.

END OF SECTION 23 22 60

**SECTION 23 23 10
LOUVERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies ductwork and air distribution equipment and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All ductwork shall be constructed and installed per the following requirements:
 - 1. SMACNA "HVAC Duct Construction Standards, Metal and Flexible"
 - 2. ASHRAE standards for duct construction.
- B. Equipment, materials and installation shall comply with the Local Mechanical Code and all requirements of the local authorities having jurisdiction.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Airolite
 - 2. American Warming and Ventilating
 - 3. Greenheck
 - 4. Ruskin
 - 5. Tamco

2.02 CONSTRUCTION

- A. Provide louvers with frame and sill styles that are compatible with adjacent substrate. Louvers shall be specifically manufactured to fit into construction openings in the adjacent substrate with accurate fit and adequate support for a weatherproof installation.
- B. Construct louvers of extruded Aluminum alloy frame and blades with all welded construction.

2.03 FINISH

- A. Louvers shall be provided with a Kynar finish.
- B. Color of louvers will be selected by the Architect. Submit manufacturers standard color charts for selection.

2.04 ACCESSORIES

- A. Provide louvers with aluminum bird screens.

PART 3 EXECUTION

3.01 GENERAL

- A. Louver installation shall not conflict with equipment or piping.
- B. Louvers shall be securely anchored in place, as recommended by the manufacturer's installation instructions.
- C. Install louvers in locations as indicated on the drawings and in accordance with the manufacturer's installation instructions.
- D. Mechanical Contractor shall locate all louver positions and dimensions and coordinate requirements with the General Contractor. The Mechanical Contractor shall install louvers.

3.02 ADJUSTING AND CLEANING

- A. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 23 10

**SECTION 23 30 10
EQUIPMENT IDENTIFICATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies mechanical system equipment identification and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

PART 2 PRODUCTS

2.01 EQUIPMENT NAMEPLATES

- A. Nameplates shall be laminated phenolic with black surface and white core. Use 1/16" thick material for plates up to 2" by 4". For larger sizes use 1/8" thick. Letters and numbers shall be a minimum of 1/2" high.

2.02 CEILING MARKERS

- A. Ceiling markers shall be provided for mechanical devices concealed above ceilings, including all terminal boxes, all fire dampers and all smoke dampers.
- B. Ceiling markers shall be 1" diameter white sticky tags with 1/4" black lettering.
- C. Markers for terminal boxes shall match the Controls address.
- D. Markers for the dampers shall follow the facility's numbering designation.
- E. Ceiling markers shall be worded as follows:
 - 1. Terminal boxes – TB-xxx where "TB" is the abbreviation for terminal box, and xxx is the BAS controls address of the terminal box.
 - 2. Fire dampers (FD), Smoke dampers (SD) and combination fire/smoke dampers (FSD) – FD-xxx where xxx is the Owner's designated damper number.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated in coordination with the Owner or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

3.03 EQUIPMENT IDENTIFICATION

- A. Provide nameplates to identify all specified equipment with letters and numbers matching equipment designation as indicated on the drawings.
- B. Nameplates shall be fastened by use of stainless steel sheet metal screws.
- C. Where equipment does not have a location for mounting of a nameplate, provide a stencil identification.

- D. Stencils shall be made with a color which stands out against the equipment finish color. Stencils shall be a minimum of 2" high.
- E. Apply one coat of lacquer or varnish over the stencils for protection.
- F. Nameplates and stencils shall be applied after any field painting of equipment.
- G. Install labels on ceiling grid at VAV locations, duct smoke detectors, differential pressure sensors and static pressure sensors. Ceiling tag shall indicate VAV terminal designation along with thermostat BAS tag.
- H. All expansion tanks, relief valves and pressure reducing valves shall have system set pressure attached to device once final set point is complete.
- I. General: Install engraved plastic equipment marker on or near each major item of mechanical equipment and each operational device. Provide signs for the following general categories of equipment and operational devices:
 - 1. Boilers
 - 2. Chillers
 - 3. Condensing Units
 - 4. Control devices including control valves, differential pressure sensors and transmitters, etc.
 - 5. Exhaust Fans
 - 6. Fans
 - 7. Heaters
 - 8. Pumps
 - 9. Reduced pressure backflow preventer.
 - 10. Variable Frequency Drives
 - 11. Water Treatment Systems

3.04 CEILING MARKERS INSTALLATION

- A. Ceiling markers shall be located in close proximity to the device it tags. Ceiling markers shall be installed on the tee bars of layin ceilings, but not on the main runs.

END OF SECTION 23 30 10

**SECTION 23 30 20
EQUIPMENT INSULATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies equipment insulation materials and installation methods common to more than one section of Division 23.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all insulation work described in this Section.

1.03 CODES AND STANDARDS

- A. Provide all insulation materials (insulation, jackets, fitting covers, adhesives, cements, mastics, sealers and finishes) with a flame-spread index of 25 or less and smoke developed index of 50 or less, as tested under procedure ASTM E-84 (NFPA 255).

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Sections 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Unless otherwise noted, and subject to compliance with Specifications, provide insulation materials from the manufacturers specified below:
 - 1. Closed Cell Elastomeric Insulation
 - a. Insul-Tube
 - b. K-Flex USA
 - c. Manson Insulation
 - d. Nomaco Kflex
 - e. Techlite Insulation
 - f. Thermacel
 - 2. Fiberglass Blanket Insulation
 - a. Certain Teed
 - b. Johns Manville
 - c. Knauf Insulation
 - d. Owens Corning
 - 3. Removable Thermal Blanket (Jacket) Insulation
 - a. Advance Thermal Corp.
 - b. Firwin Corporation.
 - c. Shannon Enterprises of W.N.Y. Inc.

d. Thermaxx, LLC.

2.02 CLOSED CELL ELASTOMERIC

- A. Provide closed cell elastomeric sheet insulation for all equipment indicated on drawings or in other sections of this Specification.
- B. Closed cell elastomeric insulation shall comply with ASTM C 534 Type I.
- C. Provide closed cell elastomeric sheet insulation for the following equipment:

Table 23 30 20.1

Equipment Type	Insulation Thickness (Sheet)
Chilled Water Pump Bodies	1"
Chilled Water Air Separators, Expansion Tanks and Suction Diffusers	1"
Chiller Evaporator and Condenser Barrels, Water Boxes and Suction Elbows	1"

2.03 FIBERGLASS EQUIPMENT INSULATION

- A. Fiberglass insulation shall have a minimum density of 2.8 lbs per cubic foot.
- B. Fiberglass insulation shall have an all service jacket.
- C. Provide fiberglass insulation for the following equipment:

Table 23 30 20.2

Equipment Type	Insulation Thickness (Sheet)
Heating Water Pump Bodies	1"
Heating Water Air Separators, Expansion Tanks and Suction Diffusers	1"

2.04 REMOVABLE THERMAL BLANKET (JACKET) INSULATION

- A. Provide a removable thermal blanket (jacket) insulation assembly for all equipment indicated on drawings or in other sections of this Specification.
- B. Operating Temperature: Maximum service temperature shall be no less than 450°F.
- C. Blanket Components: Inner and outer jacket shall be constructed of 17 oz/sq. yd. silicone impregnated fiberglass cloth.
- D. Blanket Construction: The blanket shall be a double sewn lock stitch. No raw cut edges shall be permitted. Stitching shall be done with Teflon® coated fiberglass or Teflon® coated Nomex®.
- E. Identification: All blankets shall be provided with an aluminum name plate riveted to each blanket piece. Lettering shall be 1/8" embossed to show location, description, size, pressure rating, and tag identification.
- F. Provide thermal blanket insulation for the following equipment:

Table 23 30 20.3

Equipment Type	Insulation Thickness (Sheet)
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Equipment Type	Insulation Thickness (Sheet)
Heating Water System Strainers	1"

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. Install insulation products according to manufacturer's printed instructions, in compliance with recognized industry standards and this specification.
- B. Install all insulation over clean dry surfaces. Insulation must be dry and in good condition. Wet or damaged insulation is not acceptable.
- C. Install all insulation only after the completion of system pressure tests, leakage tests and installation of heat trace.
- D. Install insulation materials with smooth even surfaces. Use full lengths of insulation where possible, only cut where necessary. Do not use cut pieces or scraps abutting each other.
- E. Repair existing equipment insulation where removed to make new connections, to add temperature controls, or where damaged by new construction. Use same insulation as specified for new service.
- F. Where existing asbestos insulation is discovered or suspected notify the building Owner immediately so it can be removed under a separate "Asbestos Removal Contract".
- G. Install insulation materials with smooth and even surfaces. Rework all poorly fitted joints. Do not use joint sealer or mastic as filler for joint gaps and excessive voids resulting from poor workmanship. Apply using staggered joint method for multi-layer installations, applying each layer of insulation separately.
- H. Coat insulated surfaces without vapor barrier with a layer of insulating cement, troweled to a smooth and continuous surface. Fill in seams, broken edges, and depressions. Cover over wire mesh and joints with cement sufficiently thick to remove surface irregularities.
- I. Maintain the integrity of factory-applied vapor barrier jacketing on all insulation, protecting it against puncture, tears or other damage.
- J. For field-applied all-service vapor barrier jacketing, neatly fit and tightly secure. Lap seams 2 inches minimum. Seal all joints with adhesive. Tape with 3 inch matching pressure-sensitive tape or 3 inch glass fabric and mastic.
- K. Removable insulation: Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance as scheduled and as required for inspection such as vessel covers, fasteners, flanges, frames, etc.
- L. On hot equipment, do not insulate handholes, clean-outs, ASME stamps and manufacturers nameplates. Bevel and seal insulation edges at these locations. On cold equipment (to prevent condensation), provide removable insulation sections over these locations. Tag surfaces to indicate what is concealed.
- M. Miter rigid fiberglass equipment insulation to fit shape of equipment and secure in place with steel bands at 12 to 18 inches on center. Seal all joints with matching pressure sensitive joint sealing tape.

3.02 PROTECTION

- A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.
- B. The insulation installer shall advise the General and the Mechanical Contractors as to requirements for protection of the insulation work during the remainder of the construction period (after the installation of insulation), to avoid damage and deterioration of the finished insulation work.

END OF SECTION 23 30 20

SECTION 23 33 52
GAS-FIRED STAINLESS STEEL CONDENSING BOILERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- B. Extent of boiler work required by this Section indicated on drawings and schedules and by requirements of this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pulse combustion boilers, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: The HVAC Contractor shall be registered with the State of Ohio, Division of Boiler Inspection. Contractor shall obtain an installation permit from the State of Ohio, Division of Boiler Inspection, prior to beginning work. Boilers' installation shall be in full compliance with all requirements of OBC Boiler Code.
- C. Codes and Standards:
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code: Section IV.
 - 3. NFPA Compliance: Install gas-fired boilers in accordance with NFPA Code 54 "National Fuel Gas Code."
 - 4. I=B=R Performance Compliance: Condensing boilers must be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.
 - 5. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
 - 6. DOE Compliance. Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
 - 7. UL Compliance. Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
 - 8. NOx Emission Standards. When installed and operated in accordance with manufacturer's instructions, condensing boilers shall comply with the NOx emission standards outlined in South Coast Air Quality Management District (SCAQMD), Rule 1146.2; and the Texas Commission on Environmental Quality (TCEQ), Title 30, Chapter 117, Rule 117.465.

D. SOURCE QUALITY CONTROL

1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code: Section IV, for low-pressure boilers.
2. Each boiler shall be factory fire tested with a combustion report supplied with the boiler or affixed to the boiler cabinet.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Handle boilers and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged boilers or components; replace with new.
- B. Store boilers and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.
- C. Comply with manufacturer's rigging and moving instructions for unloading boilers and moving them to final location.

1.05 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
 1. Prior to combustion air duct and flue vent installation, engineered calculations and drawings must be submitted to Engineer to thoroughly demonstrate that size and configuration conform to size, length and footprint for each submitted boiler as shown on the Contract documents.
 2. Efficiency Curves: At a minimum, submit efficiency curves for 100%, 50%, and 20% input firing rates at incoming water temperatures 100°F, 120°F, 140°F and 160°F.
 3. Pressure Drop Curve: Submit pressure drop curve for flows ranging from 0 GPM to design value of boiler.
- B. Shop Drawings: Provide shop drawings for boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work. Detail power, signal, and control wiring.
- C. Submit Startup service report. Include report with operation and maintenance manuals.
- D. Provide Operation and Maintenance Data for boilers in operation and maintenance manuals.

1.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base.

1.07 SPECIAL WARRANTY PERIOD FOR FIRE-TUBE CONDENSING BOILERS

- A. The pressure vessel/heat exchanger shall carry a 10-year from shipment, prorated, limited warranty against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship.
- B. Manufacturer labeled control panels are conditionally warranted against failure for (2) two years from shipment.
- C. All other components, with the exception of the igniter and flame detector, shall be guaranteed against any failure for 18 months from shipment

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. The Mechanical Contractor shall provide a maintenance kit that the boiler manufacturer recommends for its first service.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide high efficiency-condensing boilers as manufactured by one of the following:
 - 1. Aerco International (Benchmark)
 - 2. Lochinvar

2.02 GENERAL

- A. Boilers shall be natural gas fired, fully condensing, fire tube design.
- B. Power burner shall have full modulation, and discharge into a positive pressure vent.
- C. Boiler efficiency shall increase with decreasing load (output), while maintaining setpoint. Boilers shall be factory-fabricated, factory-assembled and factory-tested, fire-tube condensing boilers with heat exchanger sealed pressure-tight, built on a steel base, including insulated jacket, flue-gas vent, combustion-air intake connections, water supply, return and condensate drain connections, and controls.

2.03 HEAT EXCHANGER

- A. The heat exchanger shall be constructed of 439 stainless steel fire tubes and tubesheets, with a one-pass combustion gas flow design.
- B. The fire tubes shall be 5/8" OD, with minimum 0.049" wall thickness.
- C. The upper and lower stainless steel tubesheet shall be minimum 0.25" thick.
- D. The pressure vessel/heat exchanger shall be welded construction. The heat exchanger shall be ASME stamped for a working pressure not less than 160 psig.
- E. Access to the tubesheets and heat exchanger shall be available by burner and exhaust manifold removal. Minimum access opening shall be no less than 8-inch diameter.

2.04 PRESSURE VESSEL

- A. The boiler water connections shall be flanged, 150-pound, ANSI rated.
- B. The pressure vessel shall be constructed of SA53 carbon steel, with a 0.25-inch thick wall and 0.50-inch thick upper head.
- C. Inspection openings in the pressure vessel shall be in accordance with ASME Section IV pressure vessel code.
- D. The boiler shall be designed so that the thermal efficiency increases as the boiler firing rate decreases.

2.05 MODULATING AIR/FUEL VALVE AND BURNER

- A. The boiler burner shall be capable of a 20-to-1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves.
- B. The burner shall produce less than 16 ppm of NOx corrected to 3% excess oxygen.
- C. The unit shall be certified by the South Coast Air Quality Management District (SCAQMD) as compliant with Rule 1146.2 for boilers and water heaters less than or equal to 2 MBTUs, and the Texas Commission on Environmental Quality (TCEQ) as being compliant with Section 117.465 for boilers less than or equal to 2 MBTUs.
- D. The burner shall be metal-fiber mesh covering a stainless steel body with spark ignition and flame rectification.
- E. All burner material exposed to the combustion zone shall be of stainless steel construction.
- F. There shall be no moving parts within the burner itself.
- G. A modulating air/fuel valve shall meter the air and fuel input.

- H. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage.
- I. The linkage shall not require any field adjustment.
- J. A variable frequency drive (VFD), controlled cast aluminum pre-mix blower shall be used to ensure the optimum mixing of air and fuel between the air/fuel valve and the burner.
- K. Minimum boiler efficiencies shall be as follows at a 20 degree delta-T:

EWT	100% Fire	50% Fire	5% Fire
160 °F	86%	86.6%	88%
120 °F	88.5%	89.1%	90.9%
60 °F	95.5%	97.5%	99.3%

- L. The exhaust manifold shall be of corrosion resistant cast aluminum with a 6-inch diameter flue connection. The exhaust manifold shall have a collecting reservoir and a gravity drain for the elimination of condensation.

2.06 BLOWER

- A. The boiler shall include a variable-speed, DC centrifugal fan to operate during the burner firing sequence and pre-purge the combustion chamber.
 - 1. Motors: Blower motors shall comply with requirements specified in other Division 23 Sections.
 - a. Motor Sizes: Provide minimum size as indicated. If not indicated, large enough so driven load will not require a motor to operate in the service factor range above 1.0.

2.07 IGNITION

- A. Ignition shall be via spark ignition with 100 percent main-valve shutoff and electronic flame supervision.

2.08 CONTROLS

- A. Each boiler control panel shall consist of six individual circuit boards using state-of-the-art surface-mount technology in a single enclosure. These circuit boards shall include:
 - 1. A display board incorporating LED display to indicate temperature and a vacuum fluorescent display module for all message enunciation
 - 2. A CPU board housing all control functions
 - 3. An electric low-water cutoff board with test and manual reset functions
 - 4. A power supply board
 - 5. An ignition /stepper board incorporating flame safeguard control
 - 6. A connector board
 - 7. Each board shall be individually field replaceable.
- B. The combustion safeguard/flame monitoring system shall use spark ignition and a rectification-type flame sensor.
- C. The control panel hardware shall support both RS-232 and RS-485 remote communications.
- D. The controls shall annunciate boiler and sensor status and include extensive self-diagnostic capabilities that incorporate a minimum of eight separate status messages and 34 separate fault messages.

- E. The control panel shall incorporate three self-governing features designed to enhance operation in modes where it receives an external control signal by eliminating nuisance faults due to over-temperature, improper external signal or loss of external signal. These features include:
1. Setpoint High Limit: Setpoint high limit allows for a selectable maximum boiler outlet temperature and acts as temperature limiting governor. Setpoint limit is based on a PID function that automatically limits firing rate to maintain outlet temperature within a 0 to 10 degree selectable band from the desired maximum boiler outlet temperature.
 2. Setpoint Low Limit: Setpoint low limit allows for a selectable minimum operating temperature.
 3. Failsafe Mode: Failsafe mode allows the boiler to switch its mode to operate from an internal setpoint if its external control signal is lost, rather than shut off. This is a selectable mode, enabling the control can to shut off the unit upon loss of external signal, if so desired.
- F. The boiler control system shall incorporate the following additional features for enhanced external system interface:
1. System start temperature feature
 2. Pump delay timer
 3. Auxiliary start delay timer
 4. Auxiliary temperature sensor
 5. Analog output feature to enable simple monitoring of temperature setpoint, outlet temperature or fire rate
 6. Remote interlock circuit
 7. Delayed interlock circuit
 8. Fault relay for remote fault alarm
- G. Each boiler shall include an electric, single-seated combination safety shutoff valve/regulator with proof of closure switch in its gas train. Each boiler shall incorporate dual over-temperature protection with manual reset, in accordance with ASME Section IV and CSD-1.
- H. Each Boiler control panel shall utilize the BACNET protocol to communicate with the Building Automation System (BAS) via the RS-485 port.
- I. The BAS controller shall have the ability to vary the firing rate and energy input of each individual boiler throughout its full modulating range to maximize the condensing capability and thermal efficiency output of the entire heating plant. The BAS controller shall control the boiler outlet header temperature within +2°F. The BAS controller shall provide contact closure for auxiliary equipment such as each boiler's isolation valve and combustion air inlet dampers based upon outdoor air temperature.
- J. The BAS controller shall have the following anti-cycling features:
1. Manual designation of lead boiler and last boiler.
 2. Lead boiler rotation at user-specified time interval.
 3. Delay the firing/shutting down of boilers when header temperature is within a predefined deadband.
- K. When set on Internal Setpoint Mode, temperature control setpoint on the Boiler control panel shall be fully field adjustable from 50°F to 190°F in operation.

- L. When set on Automatic Control Mode, the BAS controller will operate the plant to vary header temperature setpoint as an external communication utilizing the hardwired connections and BACNET protocol is supplied via the RS-232 port.

2.09 ELECTRICAL POWER

- A. Controllers, Electrical Devices and Wiring: Electrical devices and connections are specified in Division 26 sections.
- B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the boiler.
- C. Electrical Characteristics:
 - 1. Voltage: 120 V
 - 2. Phase: Single
 - 3. Frequency: 60 Hz
 - 4. Full-Load Current 13 Amps

2.10 VENTING

- A. The exhaust vent shall be UL Listed for use with Category III and IV appliances and compatible with operating temperatures up to 480°F, positive pressure, condensing flue gas service. UL-listed vents of AI 29-4C stainless steel must be used with boilers.
- B. The minimum exhaust vent duct size for each boiler is six-inch diameter.
- C. Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal duct connected between the boiler and the outdoors.
- D. The minimum sealed combustion air duct size for each boiler is six-inch diameter.
- E. Common Vent and Common Combustion Air must be an available option for boiler installation. See Requirements under Part 1 – “Submittals” for common vent and combustion air sizing.
- F. Follow guidelines specified in manufacturer’s venting guide.

2.11 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions and carbon monoxide in flue gas, and to achieve combustion efficiency. Perform hydrostatic testing.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

2.12 CONDENSATE NEUTRALIZERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide high efficiency-condensing boiler condensate neutralizers as manufactured by one of the following (or approved substitution):
 - 1. BKI Industries
 - 2. CON-DOR
 - 3. JJM Boiler Works
- B. The contractor shall supply and install fireside condensate neutralizing tubes for each boiler condensate drain and all flue pipe condensate drains.
- C. The condensate tubes shall be designed to raise the PH level 10–1,000 times more towards the neutral point of the PH being discharged by the boiler.
- D. The contractor shall supply all boilers and vent condensate drains with “P-traps” and unions before the neutralizing tubes.

- E. All piping shall be CPVC and supplied/installed by the contractor. Plastic tubing is an acceptable alternative when used with barbed fittings and hose clamps. All CPVC joints shall be glued in place and all barbed fittings shall be secured with tie wraps.
- F. All neutralizing tubes shall be secured to the floor or wall so as not to be exposed to damage or within a normal walkway. The contractor shall fill all "P-traps" and neutralizing tubes with tap water before the firing of any boiler.
- G. The contractor shall inform the owner of any maintenance or scheduled recharge of the tube's limestone aggregate as described in the manufacturer's I & O manual.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Before boiler installation, examine roughing for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
- B. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- C. Examine mechanical space for suitable conditions where boilers will be installed. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Contractor is responsible to verify boiler access during bidding under the specified standard boiler or any accepted substitution boiler.

3.02 INSTALLATION

- A. Install boilers in accordance with manufacturer's published installation instructions, in accordance with State and local code requirements, and in accordance with requirements of local Utility Company.
- B. Install boilers level on concrete base. Install units plumb and level to tolerance of 1/8" in 10'-0" in both directions. Maintain manufacturer's recommended clearances around and over boilers.
- C. Install boilers in accordance with NFPA 54.
- D. Assemble and install boiler trim.
- E. Install electrical devices furnished with boiler but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect gas piping full size to boiler gas-train inlet with union, full port shut off ball valve and dirt leg.
- C. Connect hot-water piping to supply and return boiler tapplings with shutoff valve and union or flange at each connection.
- D. Install piping from safety relief valve(s) down to 6" above floor.
- E. Connect combustion air duct and flue vent full size to boiler inlet and outlet.
- F. Install piping adjacent to boiler to allow service and maintenance.
- G. Ground equipment and connect wiring according to Division 26 requirements.
- H. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque valves are not indicated, use those specified in UL 486A and UL 486B.
- I. Provide P-Trap at bottom of flue vent riser and at all low spots and extend condensate piping to neutralizers.

3.04 STARTUP SERVICE

- A. Contractor shall provide the services of a local factory authorized representative to supervise all phases of boiler equipment startup. A letter of compliance with all factory recommendations and installation instructions shall be submitted to the engineer and included with operation and maintenance instructions.
- B. Perform installation and startup checks according to manufacturer's written instructions.
- C. Perform a leak hydrostatic leak test. Repair leaks and retest until no leaks exist.
- D. Adjust air-fuel ratio and combustion.
- E. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Adjust initial temperature set points.
- G. Set field-adjustable switches and circuit-breaker trip ranges.
- H. Submit a written report that documents testing procedures and results.

3.05 DEMONSTRATION AND TRAINING

- A. Owner's Instructions: Provide services of manufacturer's technical representative for two separate 4-hour days to instruct Owner's personnel in operation and maintenance of boilers.
- B. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

END OF SECTION 23 33 52

**SECTION 23 33 70
CONDENSATE NEUTRALIZERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Specifications of this Division complement the requirements of this Section.

1.02 SUMMARY

- A. This section includes Fireside acidic condensate treatment.

1.03 QUALITY ASSURANCE

- A. All components shall be schedule 40 PVC.
- B. Manufacturer shall have a minimum of 5 years' experience specializing in the manufacturing of the products specified in this section.

1.04 WARRANTY

- A. One year warranty – parts and labor.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 CONDENSATE NEUTRALIZERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide high efficiency-condensing boiler condensate neutralizers as manufactured by one of the following (or approved substitution):
 - a. Aerco
 - b. AO Smith
 - c. Axium Industries Ltd.
 - d. BKI Industries
 - e. JJM Boiler Works
 - f. Neutrasafe Corp.
 - g. Nu-Con Company
 - h. Riesman, USA
- B. Components
 - 1. Two 6" mounting steel strut channels
 - 2. Two 3" strut clamps.
 - 3. Pre-charged pellet tube sized and rated for equipment maximum input fuel capacity.
 - 4. Two 0.5" x 0.75" barb fittings
 - 5. Inline tube shall be opaque color tubing or clear PVC tubing.
 - 6. Inline tube shall have two inlet ports and one outlet port and a removal plug for servicing.

7. Inline tube shall be supplied with a PVC threaded plug.
- C. The pellets (media) shall be calcium carbonate (calcite) or magnesium oxide and shall be designed to raise the PH level 10–1,000 times more towards the neutral point of the PH being discharged by the boiler.

PART 3 EXECUTION

3.01 GENERAL

- A. The contractor shall supply and install fireside condensate neutralizing tubes for each boiler condensate drain and all flue pipe condensate drains.
- B. The contractor shall supply all boilers and vent condensate drains with “P-traps” and unions before the neutralizing tubes.

3.02 INSTALLATION:

- A. The contractor shall use unions or tubing with clamps for easy servicing.
- B. All piping shall be CPVC or PVC and supplied/installed by the contractor. Plastic tubing is an acceptable alternative when used with barbed fittings and hose clamps. All CPVC or PVC joints shall be glued in place and all barbed fittings shall be secured with tie wraps.
- C. All neutralizing tubes shall be secured to the floor or wall so as not to be exposed to damage or within a normal walkway. The contractor shall fill all “P-traps” and neutralizing tubes with tap water before the firing of any boiler.
- D. Install in horizontal position per manufacturer’s published installation instructions.

3.03 EXTRA STOCK

- A. Manufacturer shall include additional pellets to fully charge all neutralizers provided.

3.04 COMMISSIONING:

- A. Contractor shall test pH level at the outlet of the neutralizer with a digital pH meter and include readings in O+M manual.

END OF SECTION 23 33 70

**SECTION 23 34 20
INLINE PUMPS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. Extent of hydronic pump work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings for each inline pump, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.
- B. HI Compliance: Design, manufacture, and install HVAC pumps in accordance with HI - "Hydraulic Institute Standards."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- E. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.
- F. Comply with AWWA specifications for Lineshaft Turbine Pumps.
- G. Design Criteria: The Drawings indicate sizes, profiles, connections, and dimensional requirements of plumbing pumps, and are based on the specific manufacturer types and models indicated. Pumps having equal performance characteristics by other named manufacturers may be considered, provided deviations in dimensions and profiles and efficiencies do not change the design concept or intended performance as judged by the Engineer.
- H. For variable speed pumps, pump impeller size shall be maximized for scheduled horsepower. Pump shall be non-overloading for scheduled horsepower.
- I. For constant speed pumps, impellers shall be sized for a maximum diameter not to exceed 85% of the selected pump's largest diameter.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- B. Store pumps in dry location.

- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

1.06 COORDINATION

- A. Coordinate size and location of sumps with the General Contractor.

1.07 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Mechanical Seals: Provide two mechanical seals for each pump.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide close-coupled, in-line centrifugal pumps as manufactured by one of the following:
 - 1. Armstrong Pumps Inc.
 - 2. Bell & Gossett; Div. of ITT Industries.
 - 3. PACO Pumps.
 - 4. Patterson Pumps
 - 5. Taco, Inc.

2.02 GENERAL

- A. Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.
- B. Pumps shall be rated for 175-psig minimum working pressure and a continuous water temperature of 250 °F.
- C. The pump internals shall be capable of being serviced without disturbing piping connections.
- D. Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts
- E. Each pump shall be factory tested and name-plated before shipment and shall be provided with a (3) year warranty from date of installation.

2.03 CASING

- A. Construct of cast iron, in accordance with ASTM A48 Class 30A.
- B. Pump casing/volute shall be rated for 175 psi working pressure.
- C. The pump shall be single stage, vertical split case design, in cast iron bronze fitted (or all bronze) construction.
- D. Furnish with replaceable bronze wear rings,
- E. Furnish with threaded gage tappings at inlet and outlet.
- F. Furnish with threaded companion-flange connections. Flanges shall be rated for 125-psig minimum.

2.04 IMPELLER

- A. ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw.
- B. Trim impeller to match performance scheduled on the drawings.

2.05 PUMP SHAFT

- A. Construct of carbon steel supported by two sealed ball bearings.
- B. Furnish with bronze sleeve, meeting ASTM B584-932 or stainless steel.

2.06 MECHANICAL SEAL

- A. Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket.
- B. Include water slinger on shaft between motor and seal.

2.07 PUMP BEARINGS

- A. Permanently lubricated ball bearings.

2.08 MOTOR

- A. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design.
- B. Motors through 1 HP shall be resilient mounted, motors over 1.5 HP shall be ridged mounted. Motors shall have permanently lubricated ball bearings and must be completely maintenance free.
- C. Motor selection shall be non-overloading at any point on the pump curve and shall meet NEMA specifications for premium efficiency
- D. Motor shall be inverter rated with class F insulation, for use with a variable frequency drive

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine pump supports for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with HI 1.4 HI 2.4, as applicable.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install pumps with motor and pump shafts vertical.

3.03 ALIGNMENT

- A. Align pump with piping connections after setting on foundation or supports
- B. Comply with pump and coupling manufacturers' written instructions.

3.04 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pump to allow service and maintenance of pump.
- C. Connect piping to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install check valve, spool piece, and shutoff throttling valve on discharge side of pumps.
- F. Install suction diffuser venturi fitting, reducing elbow (where applicable), Y-strainer, and shutoff valve on suction side of pumps.

- G. Install flexible connectors on suction and discharge sides of pumps between pump casing and valves.
- H. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
- I. Install electrical connections for power, controls, and devices.
- J. Ground equipment according to Division 26 requirements.
- K. Connect wiring according to Division 26 requirements.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 6. Start motor.
 - 7. Open discharge valve slowly.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 23 34 20

SECTION 23 50 11
CENTRIFUGAL ROOF EXHAUST FANS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies down-blast centrifugal roof fans and air distribution equipment and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. Extent of work required for fans is indicated by drawings and schedules and as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fans, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. AMCA Compliance: Provide fans which have been tested and rated in accordance with AMCA standards and bear AMCA Certified Rating Seal.
- B. UL Compliance: Provide fans which are listed by UL and have UL label affixed.
- C. UL Compliance: Provide fans which are designed, manufactured and tested in accordance with UL 705 "Power Ventilators".
- D. NEMA Compliance: Provide motors and electrical accessories complying with NEMA standards.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver fans in factory-fabricated crates, containers or wrappings which properly protect fans from damage.
- B. Store fans in original packaging and protect from weather and construction traffic. Wherever possible, store in doors. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle fans carefully to prevent damage, breaking, denting and scoring of finishes. Do not install damaged units or components; replace with new.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide down-blast centrifugal roof fans as manufactured by one of the following:

20178 CMHA The Beechwood 23 50 11 - 1 CENTRIFUGAL ROOF EXHAUST FANS

1. Greenheck Fan Corp.
2. Cook (Loren) Co.
3. New York Blower Company
4. Twin City

2.02 GENERAL

- A. Provide belt-driven, spun aluminum, down-blast fans of the sizes and capacities as scheduled and herein specified consisting of fan blades, hub, housing, motor, drive, roof curb and accessories.

2.03 FAN WHEEL

- A. The fan wheel shall be centrifugal non-overloading backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced in accordance to AMCA Standard 204-05.

2.04 FAN HOUSING

- A. The fan housing shall consist of the motor cover, shroud, curb cap and lower windband and shall be constructed of heavy gauge aluminum. Housing shall have a rigid internal support structure and leak proof design. The fan shroud shall be one piece with a rolled bead for extra strength which directs exhaust air downward. The lower windband shall be one piece with formed edges for added strength and the curb cap shall include prepunched mounting holes to ensure correct attachment to the roof.

2.05 FAN SHAFTS

- A. Fan shafts shall be precision ground and polished solid steel with an anti-corrosive coating. Fan shafts shall be mounted in permanently sealed lubricated pillow block ball bearings. The first critical speed on a fan shaft shall be at least 25 percent over maximum operating speed. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at a maximum cataloged operating speed. All bearings shall be 100 percent factory tested.

2.06 DRIVE FRAME

- A. Belt Drive
 1. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
 2. Pulleys shall be of the fully machined cast iron type, keyed and security attached to the wheel and motor shafts.
 3. Motor pulleys shall be fixed pitch type.

2.07 MOTORS

- A. Belt-Drive:
 1. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specific voltage, phase and enclosure.
 2. Drives shall be sized for a minimum of 150 percent of driven horsepower.
 3. Motors and drives shall be mounted on vibration isolators, out of the airstream.
 4. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants.
 5. Motors shall be readily accessible for maintenance.
 6. Vibration isolators shall be double studded or pedestal mount with no metal to metal contact. Each vibration isolator shall be sized to match the weight of each fan.

B. Direct Drive

1. Motors shall be a DC electronic commutation type motor (ECM) specifically designed for fan applications.
2. ECM motors shall have open type enclosures.
3. Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
4. Furnish with all necessary internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
6. Motor shall be minimum 85% efficient at all speeds.
7. AC induction type motors are not acceptable for direct drive fan applications.

2.08 DISCONNECT

- A. A disconnect switch shall be wired from the fan motor to a junction box installed within the motor compartment.
- B. Disconnect switch shall be factory mounted.

2.09 OPTIONS AND ACCESSORIES

- A. Furnish each fan with options and accessories as indicated on the schedule on the drawings.
 1. Auto belt tensioner
 2. Bird screen
 3. Curb extension
 4. Curb seal
 5. Hinge kit with base
 6. Roof curb and tie down points

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected

3.02 INSTALLATION

- A. General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognize industry practices to insure that fans serve their intended function
- B. Coordinate fans and accessories with roofing work, as necessary for proper interfacing.
- C. Remove shipping bolts, blocks and temporary supports within fans. Adjust dampers for free operation.
- D. Provide roof curbs to the General Contractor at the job site. Roof curbs shall be installed by and incorporated into the roofing system by the General Contractor.

3.03 ELECTRICAL WIRING

- A. Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer wiring diagram submittal to Electrical Installer.

- B. Verify that motors and electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Verify proper rotation directions of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.04 FIELD QUALITY CONTROL

- A. Testing: After installation of fans has been completed, test each fan to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.05 ADJUSTING AND CLEANING

- A. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 50 11

SECTION 23 50 14
CENTRIFUGAL UTILITY FANS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies centrifugal utility fans and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. Extent of work required for fans is indicated by drawings and schedules and as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fans, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. AMCA Compliance: Provide fans which have been tested and rated in accordance with AMCA standards and bear AMCA Certified Rating Seal.
- B. UL Compliance: Provide fans which are listed by UL and have UL label affixed.
- C. UL Compliance: Provide fans which are designed, manufactured and tested in accordance with UL 705 "Power Ventilators".
- D. All kitchen hood exhaust fans shall be constructed in compliance with UL-762 "Power Ventilators for Restaurant Exhaust Appliances".
- E. NEMA Compliance: Provide motors and electrical accessories complying with NEMA standards.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver fans in factory-fabricated crates, containers or wrappings which properly protect fans from damage.
- B. Store fans in original packaging and protect from weather and construction traffic. Wherever possible, store in doors. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle fans carefully to prevent damage, breaking, denting and scoring of finishes. Do not install damaged units or components; replace with new.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide centrifugal roof fans as manufactured by one of the following:
 - 1. Greenheck.
 - 2. Loren Cook Company.
 - 3. New York Blower Company.
 - 4. Twin City Fan Company.

2.02 GENERAL

- A. Direct- or belt-driven centrifugal utility fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- B. Provide single width/single inlet, centrifugal utility fans with drive type (direct or belt) and arrangement as scheduled on the drawings.

2.03 FAN HOUSING

- A. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The entire fan steel housing shall have air-tight, locked formed seams for leak proof operation.
- B. The fan housing shall be field rotatable to any one of eight discharge positions and shall have an inlet and outlet discharge flange.
- C. Bearing support shall be a minimum of 10 gauge welded steel. Inspection/cleanout doors in scroll shall be provided. Where scheduled provide with a removable weather hood to completely cover motor and drive components. Housing and all steel supports shall be painted. Provide drain connection on bottom of housing.
- D. Motor shall be heavy duty type with permanently lubricated sealed ball bearings. Motor shall be mounted out of the air stream.
- E. Fan bearings shall be heavy duty ball type with a cast iron housing, with a minimum L50 life rated in excess of 200,000 hours at a maximum cataloged operating speed.
- F. Belts shall be oil and heat resistant, non-static type. Drives shall be machined cast iron, keyed and securely attached to wheel and motor shafts and sized for 150 percent of the installed motor horsepower. Drives shall be fixed pitch type.

2.04 FAN WHEELS

- A. Wheel shall be centrifugal backwardly inclined or forward curved type as scheduled.
- B. Wheel hub shall be keyed and securely attached to the fan shaft.
- C. Wheel shall utilize a one piece aerodynamic inlet cone.
- D. Wheel shall be balanced in accordance with AMCA standard 204-96: Balance Quality and Vibration Levels for Fans.

2.05 ACCESSORIES

- A. Furnish with a factory installed and wired disconnect, where indicated on the plans.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognize industry practices to insure that ventilators serve their intended function.

- B. Install fans level and plumb on support base.

3.03 ELECTRICAL WIRING

- A. Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer wiring diagram submittal to Electrical Installer.
- B. Verify that motors and electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Verify proper rotation directions of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- C. Remove shipping bolts, blocks and temporary supports within fans. Adjust dampers for free operation.

3.04 FIELD QUALITY CONTROL

- A. Testing: After installation of fans has been completed, test each fan to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.05 ADJUSTING AND CLEANING

- A. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 50 14

**SECTION 23 50 50
PROPELLER FANS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies down-blast centrifugal roof fans and air distribution equipment and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.
- C. Extent of work required for fans is indicated by drawings and schedules and as specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fans, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.04 CODES AND STANDARDS

- A. AMCA Compliance: Provide fans which have been tested and rated in accordance with AMCA standards and bear AMCA Certified Rating Seal.
- B. UL Compliance: Provide fans which are listed by UL and have UL label affixed.
- C. UL Compliance: Provide fans which are designed, manufactured and tested in accordance with UL 705 "Power Ventilators".
- D. NEMA Compliance: Provide motors and electrical accessories complying with NEMA standards.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver fans in factory-fabricated crates, containers or wrappings which properly protect fans from damage.
- B. Store fans in original packaging and protect from weather and construction traffic. Wherever possible, store in doors. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle fans carefully to prevent damage, breaking, denting and scoring of finishes. Do not install damaged units or components; replace with new.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide down-blast centrifugal roof fans as manufactured by one of the following:

1. Greenheck Fan Corp.
2. Cook (Loren) Co.
3. New York Blower Company
4. Twin City

2.02 BELT DRIVE SIDEWALL MOUNTED PROPELLER FANS

A. General Description:

1. Fan arrangement shall be either supply or exhaust, see Fan Schedule
2. Sidewall mounted applications
3. Maximum continuous operating temperature 130 Fahrenheit (54.4 Celsius)
4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:

1. Constructed of welded steel blades and hubs
2. Securely attached to fan shaft with a standard square key and set screw or tapered bushing
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The propeller and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

C. Motors:

1. Motor enclosures: Totally enclosed fan cooled.
2. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase
3. Accessible for maintenance

D. Shafts and Bearings:

1. Fan Shaft shall be ground and polished solid steel with an anti-corrosive coating
2. Bearing shall be cast iron pillow block with grease fittings
3. Bearings shall be selected for a minimum L10 life in excess of 100,00 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
4. Bearing shall be air handling quality and 100% factory tested by bearing manufacturer
5. Fan Shaft first critical speed is at least 25 percent over maximum operating speed

E. Drive Frame:

1. Bolted structural steel channel construction
2. Shall be galvanized steel with one piece drawn venturi
3. One-piece motor/bearing plate on sizes 24-36 and two piece sizes on 42-72

F. Disconnect Switches:

1. NEMA rated: [1] [3R] [4] [4X] [7&9] [12]
2. Positive electrical shut-off
3. Wired from fan motor to junction box

- G. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower
 2. Belt: Static free and oil resistant
 3. Readily accessible for maintenance
 4. Fully machined cast iron pulleys, keyed and securely attached to the wheel and motor shafts
 5. The motor pulley shall be adjustable for final system balancing

EDIT OPTIONS AND ACCESSORIES

2.03 Options/Accessories:

- A. Closure Angles:
1. Extra set of mounting flanges shall be available for field installation to close off the interior wall opening for a finished appearance
- B. Dampers:
1. Type: [Gravity] [Motorized]
 2. Prevents outside air from entering back into the building when fan is off
 3. Balanced for minimal resistance to flow
 4. Galvanized frames with pre-punched mounting holes
- C. Dampers Guards:
1. Guard material: [Galvanized] [Aluminum]
 2. Shall completely enclose the damper or wall opening on the discharge side of the fan
- D. Diffusers:
1. Constructed of heavy gauge galvanized steel frame and blades
 2. Shall have pre-punched mounting flanges
 3. Designed to mount to the interior end of the wall housing when used in the supply configuration
- E. Finishes:
1. Types: [Permatecor] [Hi-Pro Polyester] [Primer] [Baked Enamel] [Epoxy] [Industrial Epoxy]
- F. Horizontal Mounting:
1. Allows fan to be mounted in a horizontal configuration
 2. Location: [None] [Motor Top, Air Down] [Motor Bottom, Air Up] [Motor Top, Air Up] [Motor Bottom, Air Down]
- G. Wall Housing:
1. Mounting arrangement: [Flush Interior] [Flush Exterior] [Motor Access Interior] [Motor Access Exterior]
 2. Constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes
 3. Housing shall include OSHA approved motor guard
 4. Reduces installation time and provides maximum installation flexibility

- H. Wall Collar:
 - 1. Constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes
- I. Motor Side Guard:
 - 1. Guard type: [Standard Guard] [OSHA Guard]
 - 2. Protective guard completely enclose the motor and drive side of the fan
- J. Weatherhood Kit:
 - 1. Shall shield wall opening and dampers from rain and snow
 - 2. Material type: [Galvanized] [Aluminum]
 - 3. Turndown Angle: [45] [90] degrees
 - 4. Screen: [Birdscreen] [Insect screen]
 - 5. Finishes: [None] [Permatector] [Hi-Pro Polyester] [Primer] [Baked Enamel]

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions

3.02 EXAMINATION

- A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected

3.03 PREPARATION

- A. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance Ensure duct is plumb, sized correctly, and to proper elevation above roof deck. Install duct as specified in Air Distribution (Division 23)

3.04 INSTALLATION

- A. Install fans system as indicated on the Installation, Operation and Maintenance Manual (IOM) and contract drawings
- B. Install fans in accordance with manufacturer's instructions

3.05 SYSTEM STARTUP

- A. Refer to Installation, Operation, and Maintenance Manual (IOM)

3.06 ADJUSTING

- A. Adjust exhaust fans to function properly
- B. Adjust Belt Tension
- C. Lubricate bearings
- D. Adjust drive for final system balancing
- E. Check wheel overlap

3.07 CLEANING

- A. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction

3.08 PROTECTION

- A. Protect installed product and finished surfaces from damage during construction. Protect installed exhaust fans to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion

END OF SECTION 23 50 50

**SECTION 23 70 10
HYDRONIC CONVECTORS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section specifies convectors and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All HVAC equipment shall comply with requirements of the Local Mechanical Code and the local authorities having jurisdiction.
- B. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.
- C. ARI Compliance: Provide coil rating in accordance with ARI Standard 410 "Forced-Circulation Air-Cooling and Air-Heating Coils."
- D. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils"

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.
- D. Shop Drawings
 - 1. Provide Shop Drawings for each type, size, and orientation of convectors.
 - 2. Shop Drawings shall contain the following information:
 - a. General:
 - 1). Model Number
 - 2). Dimensions
 - 3). Weight
 - 4). Clearance requirements
 - 5). Special rigging requirements
 - 6). Material
 - 7). Color and finish
 - 8). Installation recommendations
 - 9). Ratings
 - 10). All included options and accessories

- b. Performance:
 - 1). Performance data as scheduled and/or specified (at a minimum)
 - 2). Code\standard compliance information
 - 3). Pressure drop curve or chart
- c. Connections:
 - 1). All pipe connections, including:
 - a). Size(s)
 - b). Location(s)
 - c). Connection service
 - d). Connection method
 - 2). All duct connections including:
 - a). Size(s)
 - b). Location(s)
 - c). Connection service
 - d). Connection method
- d. Controls:
 - 1). Wiring terminations for required interlock and control wiring
 - 2). Wiring diagram, with factory installed and field installed portions clearly differentiated.
 - 3). Thermostat
 - 4). Sequence of operations
- E. Operation and Maintenance Manuals
 - 1. O&M Manuals shall include the following:
 - a. Final approved shop drawings, with Engineer's approval attached
 - b. All applicable start-up documents
 - c. Manufacturer's maintenance instructions, including:
 - 1). Recommended maintenance frequency
 - 2). Trouble shooting guide
 - 3). Spare parts lists

1.05 DELIVERY, STORAGE AND HANDLING

- A. Handle units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged units or components; replace with new.
- B. Store units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading units and moving them to final location.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide convectors as manufactured by one of the following:
 - 1. Carrier
 - 2. Sterling
 - 3. Trane
 - 4. York/Johnson

2.02 GENERAL

- A. Provide convectors in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit: chassis, coil, and insulation.

2.03 CHASSIS

- A. Galvanized steel wrap-around structural frame with edges flanged.
- B. Insulation: Faced, heavy density glass fiber.

2.04 CABINET

- A. Construct of 16 gauge removable front panel, 18 gauge top and side panels.
- B. Insulate front panel over entire coil section.
- C. Provide access door on coil connection side.
- D. Clean cabinet parts, bonderize, phosphatized, and flow-coat with baked-on primer and finished coat (color as selected by Architect).

2.05 HYDRONIC COILS

- A. Construct of seamless copper tubes mechanically bonded to collared aluminum fins.
- B. Designs for 300 psi and leak test at 450 psi under water.
- C. Provide same end connections for supply and return.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install convectors as indicated, and in accordance with manufacturer's installation instructions.
- B. Uncrate units and inspect for damage.
- C. Verify that nameplate data corresponds with unit designation.
- D. Locate convectors as indicated, coordinate with other trades to assure correct recess size for recessed units.
- E. Install piping as indicated.
- F. Protect units with protective covers during balance of construction

3.02 ADJUSTING AND CLEANING

- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean coils and inside of cabinets, using finish materials furnished by Manufacturer.

END OF SECTION 23 70 10

**SECTION 23 72 10
HYDRONIC FINNED TUBE**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies finned tube radiation equipment and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. All HVAC equipment shall comply with the requirements of the Local Mechanical Code and the local authorities having jurisdiction.
- B. I=B=R Compliance: Test and rate baseboard and finned tube radiation in accordance with I=B=R, provide published ratings bearing emblem of I=B=R.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.
- D. Product Data: Submit manufacturer's specifications for finned tube radiation showing dimensions, capacities, ratings, performance characteristics, gauges and finishes of materials and installation instructions.
- E. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Handle finned tube radiation and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged units or components; replace with new.
- B. Store finned tube radiation and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading finned tube radiation components and moving them to final location.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Rittling
 - 2. Runtal
 - 3. Vulcan
 - 4. Sterling
 - 5. Trane

2.02 GENERAL

- A. Provide finned tube radiation of lengths and in locations as indicated, and of capacities, style, and having accessories as scheduled and detailed.

2.03 ENCLOSURE

- A. Enclosure shall be a minimum of 18 gauge cold-rolled steel with partial backplate, minimum 16 gauge front. Brace and reinforce front minimum of 4' 0" o.c. without visible fasteners.

2.04 ELEMENTS

- A. Hydronic heating elements shall be copper tube and aluminum fins, with tube mechanically expanded into fin collars to eliminate noise and ensure durability and performance at scheduled ratings.

2.05 FACTORY FINISHES

- A. Factory-finished baked enamel, on fronts, tops and accessories, color as selected by Architect.

2.06 AVAILABLE ACCESSORIES

- A. End Panels, inside and outside corners, and enclosure extensions.
- B. Access panels in front of valves and balancing cocks with tamper-proof closure.
- C. Factory-mounted dampers with knob operator for all enclosures over top opening length. Slide dampers will not be permitted.
- D. Sill extensions.
- E. Mullion channels.
- F. Pilaster covers.
- G. Expansion compensators.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. General: Install finned tube radiation as indicated, and in accordance with manufacturer's installation instructions.
- B. Locate finned tube radiation on outside walls as indicated, run cover wall-to-wall unless otherwise indicated.
- C. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window.
- D. Install end caps where units butt against walls. Install access panels centered in front of each shut-off valve, balancing cock, steam trap, or temperature control valve.
- E. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 72 10

**SECTION 23 75 10
HYDRONIC FAN COIL UNITS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section specifies fan coil units and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.
- B. ARI Compliance: Provide coil rating in accordance with ARI Standard 410 "Forced-Circulation Air-Cooling and Air-Heating Coils."
- C. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils"
- D. UL Compliance: Provide electrical components for unit heaters which have been listed and labeled by UL.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.
- D. Furnish submittals are required per section 23 01 10 "Project Submittal Requirements"

1.05 DELIVERY, STORAGE AND HANDLING

- A. Handle units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged units or components; replace with new.
- B. Store units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading units and moving them to final location.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products as manufactured by one of the following:
 - 1. Airtherm
 - 2. Carrier
 - 3. Modine
 - 4. Rittling

5. Sterling
6. Trane
7. Vulcan
8. York/Johnson

2.02 General

- A. Provide fan coil units in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit: chassis, coils, fanboard, fan wheels, housings, motor and insulation.

2.03 Chassis

- A. Galvanized steel wrap-around structural frame with edges flanged.

2.04 Insulation

- A. Faced, heavy density glass fiber.

2.05 Cabinet

- A. 16 gauge removable front panel, 18 gauge top and side panels. Insulate front panel over entire coil section. Provide access door on coil connection side. Clean cabinet parts, bonderize, phosphatized, and flow-coat with baked-on primer and finished coat (color for units exposed to view shall be as selected by Architect). For ducted horizontal units, provide inlet and outlet collars.

2.06 Fans

- A. Provide centrifugal, forward curved double width fan wheels constructed of non-corrosive, molded fiberglass-reinforced thermoplastic material. Construct fan scrolls of galvanized steel. Fans shall be factory balanced.

2.07 Motors

- A. Provide permanent split capacitor multi-speed motors with integral thermal overload protection, and motor cords for plug-in to junction box in unit.

2.08 Water Coils

- A. Construct of 1/2" or 5/8" seamless copper tubes mechanically bonded to configured aluminum fin. Design for 250 psi and leak test at 300 psi under water. Provide same end connections for supply and return.

2.09 Drain Pans

- A. Construct of galvanized steel. Insulate with polystyrene or polyurethane insulation. Provide drain connection. Provide floor units with auxiliary drain pan. Provide ceiling units with secondary drain pan and drip lip extension under valving.

2.10 Filter

- A. Provide 1" thick throw-away filters.

2.11 Accessories

- A. Provide the following accessories as indicated and/or scheduled:
 1. Disconnect switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 2. The Controls Contractor shall provide each fan coil with field installed controls. Manufacturer shall furnish a controls enclosure with factory installed and wired 3-speed fan switch and terminal block for field controls interface.
 3. Valving and coil piping shall be furnished by the Controls Contractor and shall be in accordance with the piping detail on the drawings. See Specification Section "Sequence of Operation" for controls, to be furnished by others.

4. Inlet and Discharge grille arrangements shall be as scheduled and shown on the drawings.
5. Furnish duct connection flanges for ducted units. Furnish motor with sufficient external static pressure capabilities to allow air circulation through field installed ductwork and intake/distribution grilles.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. General: Install fan coil units as indicated, and in accordance with manufacturer's installation instructions. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- B. Locate fan coil unit as indicated, coordinate with other trades to assure correct recess size for recessed units. Hang ceiling units from building substrate, not from piping. Support units with rod type hangers anchored to building substrate and rubber grommet insulators. Maintain access clearance to filters and internal components.
- C. Install piping as indicated.
- D. Protect units with protective covers during balance of construction

3.02 ELECTRICAL WIRING

- A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electric Installer.
 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.03 ADJUSTING AND CLEANING

- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean coils and inside of cabinets, using finish materials furnished by Manufacturer.
- B. Install new filters for units requiring same

END OF SECTION 23 75 10

**SECTION 23 76 10
HYDRONIC UNIT HEATERS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies unit heaters equipment and accessories, and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. Unit heaters shall be provided with electric motors and components that are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags on each section to indicate location and orientation in direction of airflow. Each section shall have lifting points to allow for field rigging and final placement of section.
- C. Store in a clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide unit heaters as manufactured by one of the following:
 - 1. Airtherm
 - 2. Carrier
 - 3. Daikin
 - 4. Modine
 - 5. Sterling
 - 6. Trane
 - 7. Vulcan
 - 8. York/Johnson

9. Rittling

2.02 CASINGS

- A. Casings shall be minimum 20 gauge die-formed steel.
- B. Casings shall be hot washed with iron phosphatizing clear rinse, oven dried and painted with a baked enamel finish.

2.03 FANS

- A. Fans shall be factory balanced with aluminum spark proof blades and steel hubs.
- B. Furnish vertical units with fan inlet guards.
- C. Motors shall be totally enclosed, resilient mounted with class "B" windings and built-in thermal overload protection.

2.04 HYDRONIC COILS

- A. Heating coils shall be suitable for use in steam or hot water applications.
- B. Coil elements and headers shall be heavy wall drawn seamless copper tubing.
- C. Element tubes shall be brazed into extruded header junctions.
- D. Pipe connection saddles shall be of cast bronze.
- E. Aluminum fins shall have drawn collars to assure permanent bond with expanded element tubes and exact spacing.
- F. Elements shall be tested at 250 psi air pressure under water, under maximum load conditions.

2.05 ACCESSORIES

- A. Furnish horizontal units with adjustable four-way air diffusion. Furnish vertical units with louver cone diffuser for air diffusion.

PART 3 EXECUTION

3.01 GENERAL

- A. All equipment shall be installed plumb and level, firmly anchored in locations indicated and in accordance with the equipment manufacturers recommendations.
- B. All equipment shall be installed with adequate clearance provided for routine maintenance and servicing.
- C. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.02 INSTALLATION

- A. Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.
- B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- C. Support units with rod-type hangers anchored to building substrate.
- D. Install piping as indicated.
- E. Protect units with protective covers during balance of construction.

3.03 ELECTRICAL WIRING

- A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electric installer.
- B. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.04 ADJUSTING AND CLEANING

- A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets and comb out coil fins.
- B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION 23 76 10

SECTION 23 77 10
HYDRONIC CABINET UNIT HEATERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies cabinet unit heaters and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 CODES AND STANDARDS

- A. ARI Compliance: Provide coil ratings in accordance with ARI Standard 410 "Forced-Circulation Air-Cooling and Air-Heating Coils."
- B. ASHRAE Compliance: Test coils in accordance with ASHRAE Standard 33 "Methods of Testing Forced Circulation Air Cooling and Heating Coils."
- C. UL Compliance: Construct and install cabinet heaters in compliance with UL 883 "Safety Standards for Fan Coil Units and Room Fan Heater Units."
- D. UL Compliance: Provide electrical components for cabinet unit heaters which have been listed and labeled by UL.
- E. NFPA Compliance: Construct cabinet unit heaters using acoustical and thermal insulations complying with NFPA 90A "Air Conditioning and Ventilating Systems."

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.
- D. Furnish submittals are required per section 23 01 10 "Project Submittal Requirements"

1.05 DELIVERY, STORAGE AND HANDLING

- A. Handle cabinet unit heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.
- B. Store cabinet unit heaters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading cabinet unit heaters and moving them to final location.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide cabinet unit heaters as manufactured by one of the following:
 - 1. Airtherm
 - 2. Carrier

3. Daikin
4. Modine
5. Sterling
6. Trane
7. Vulcan
8. York/Johnson
9. Rittling

2.02 GENERAL

- A. Provide cabinet heaters having cabinet sizes and in locations as indicated, of capacities, style, and having accessories as scheduled, and herein specified. Include in basic unit: chassis, coil, fanboard, fan wheels, housings, motor, integral thermostat, and insulation.

2.03 CHASSIS

- A. Galvanized steel wrap-around structural frame with edges flanged.

2.04 INSULATION

- A. Faced, heavy density glass fiber.

2.05 CABINET

- A. 16 gauge removable front panel, 18 gauge top and side panels.
- B. Insulate front panel over entire coil section.
- C. Provide access door on coil connection side.
- D. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked on primer and final enamel coat.
- E. Color shall be as selected by Architect.
- F. For ducted horizontal units, provide inlet and outlet duct collars.

2.06 WATER COILS

- A. Construct 1/2" or 5/8" seamless copper tubes mechanically bonded to configured aluminum fins.
- B. Design for 250 psi and leak test at 300 psi under water.
- C. Provide same end connections for supply and return.

2.07 FANS

- A. Provide centrifugal, forward curved double width fan wheels constructed of non-corrosive, molded fiberglass-reinforced thermoplastic material.
- B. Construct fan scrolls of galvanized steel.

2.08 MOTORS

- A. Provide permanent split capacitor motors with integral thermal overload protection, and motor cords for plug-in to junction box with unit.

2.09 FILTERS

- A. Provide 1" thick throwaway type filters.

2.10 ACCESSORIES

- A. Recessing Flanges: Provide 18-ga steel flanges for recessing cabinet heaters into wall or ceiling.
- B. Sub-bases: Provide minimum 18-ga steel sub-base for vertical units of height as indicated.

- C. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
- D. Inlet and Discharge grille arrangements shall be as scheduled and shown on the drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install cabinet heaters as indicated, and in accordance with manufacturer's installation instructions. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
- B. Locate cabinet heaters, plumb and level, firmly anchored in locations indicated. Coordinate with other traces to assure correct recess size for recessed units. Hang ceiling units from building substrate, not from piping. Support units with rod-type hangers anchored to building substrate.
- C. All equipment shall be installed with adequate clearance provided for routine maintenance and servicing. Locate horizontal, above-ceiling units to maintain access with ceiling components below.
- D. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- E. Install piping as indicated.
- F. Protect units with protective covers during balance of constructions.

3.02 ELECTRICAL WIRING

- A. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electric Installer.
- B. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.03 ADJUSTING AND CLEANING

- A. General: After construction is complete, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets and comb out coil fins.
- B. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by the manufacturer.
- C. Install new filters for cabinet heaters requiring same.

END OF SECTION 23 77 10

SECTION 23 81 10
DUCTLESS SPLIT AIR CONDITIONING SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.
- C. Provide motors as described elsewhere in these specifications.

1.02 SCOPE

- A. This Section specifies Direct Expansion (DX) split air conditioning units and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 QUALITY ASSURANCE

- A. Units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.
- C. Units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the ARI Certification label.
- D. Units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- E. A nitrogen holding charge shall be provided in the indoor (evaporator) section at the time of shipment.
- F. The outdoor unit shall be pre-charged with an adequate amount of R-410a refrigerant to accommodate 70 feet of refrigerant tubing.
- G. Manufacturer shall have over ten (10) years of continuous experience in the U.S. market.

1.04 CODES AND STANDARDS

- A. Equipment, materials and installation shall comply with the Ohio Mechanical Code, the Ohio Pressure piping Code, and all requirements of the local authorities having jurisdiction.
- B. Refrigeration system and condensing units shall be constructed and installed in accordance with latest ASHRAE Standard "Safety Code for Mechanical Refrigeration".
- C. Equipment shall be listed by UL and have UL label affixed.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report: Provide completed start-up form, per the requirements of Section 23 03 20.
- D. Furnish submittals are required per section 23 01 10 "Project Submittal Requirements"

1.06 WARRANTY

- A. Units shall have a manufacturer's parts and defects warranty for a period five (5) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
- B. Manufacturer shall have over ten (10) years of continuous experience in the U.S. market.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. All DX Split Air Conditioning System equipment shall be provided by one manufacturer. Subject to compliance with requirements, provide equipment by one of the following acceptable manufacturers:
 - 1. Daikin
 - 2. Friedrich
 - 3. Mitsubishi
 - 4. Sanyo
 - 5. Toshiba/Carrier

2.02 SYSTEM COOLING PERFORMANCE

- A. Cooling performance shall be based on 80°F dry bulb, 67°F wet bulb for the indoor unit and 95°F dry bulb, 75°F wet bulb for the outdoor unit.

Editor's Note – Edit indoor unit types

2.03 SPLIT SYSTEM INDOOR UNITS

- A. Ceiling Suspended Type
 - 1. Ceiling Suspended type indoor units shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit, in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.
 - 2. Unit Cabinet: The casing shall be ABS plastic and have a white finish. Cabinet shall be designed for suspension mounting from above and horizontal operation. Indoor unit shall have removable mounting brackets. A mounting template with suspension bolt locations shall be furnished with indoor unit. Mounting bolts or threaded rod of 3/8" diameter shall be used to suspend unit and unit shall not require direct contact with ceiling or panel for proper operation. Mounting support shall be of sufficient strength and design to support full weight of indoor unit. The rear cabinet panel shall have knock-out provisions for a field installed filtered 4-5/16 diameter ventilation air intake connection.
 - 3. Fan: The indoor unit fan shall have multiple high performance, double inlet, forward curve sirocco fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of four (4) speeds: Low, M1, M2, and Hi plus AUTO fan setting. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and sensed space temperature.
 - a. Indoor unit sound level shall not exceed the levels below:

Tonnage	Low Speed	M1 Speed	M2 Speed	High Speed
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2	33 dB(A)	35 dB(A)	37 dB(A)	40 dB(A)
2.5	35 dB(A)	37 dB(A)	39 dB(A)	41 dB(A)
3	37 dB(A)	39 dB(A)	41 dB(A)	43 dB(A)
3.5	39 dB(A)	41 dB(A)	43 dB(A)	45 dB(A)

4. Vane: There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five (5) vertical airflow patterns selected by remote control: 100% horizontal flow, 80% horizontal flow (plus 20% downward airflow), 60% horizontal airflow (plus 40% downward airflow), 40% horizontal airflow (plus 60% downward airflow), and swing. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.
5. Filter: Return air shall be filtered by means of an easily removable washable filter.
6. Coil: The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

*****Optional Condensate Pump***:**

7. An optional drain lift mechanism, capable of lifting condensate 18 inches above the drain pan shall be provided. Lift mechanism shall incorporate a safety sensor system to shut down the indoor fan and the compressor in the outdoor unit in the event of high level of condensate in the drain pan
8. Electrical: The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the Mitsubishi Electric A-Control system. For A-Control, a three (3) conductor AWG-14 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. If code requires a disconnect mounted near the indoor unit, a TAZ-MS303 3-Pole Disconnect shall be used – all three conductors must be interrupted.
9. System Control: The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit. The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Up to two wired controllers shall be able to be used to control one unit.
 - a. For A-Control, a three (3) conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. . If code requires a disconnect mounted near the indoor unit, a TAZ-MS303 3-Pole Disconnect shall be used – all three conductors must be interrupted.
 - b. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including

- total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.
- c. The indoor unit control board shall have auxiliary control contact connectors to provide remote switch, central control, and IP terminal.
 - d. The indoor unit shall be connected to a wall mounted wired controller to perform input functions necessary to operate the system. The wired controller shall have a large multi-language DOT liquid crystal display (LCD) presenting contents. There shall be a built-in weekly timer with up to eight pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F). Temperature changes shall be by increments of 1°F with a range of 67°F to 87°F.
 - e. The wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), LEV opening pulses, sub cooling and discharge super heat. Normal operation of the wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room. The controller shall have the capability of controlling up to a maximum of sixteen systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet.
 - f. Control system shall provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.
 - g. Furnish unit with condensate drain pan level sensor to shutdown unit and prevent drain pan overflow.

*****OPTION: Wireless Remote Controller***:**

10. Wireless Remote Controller
 - a. The unit shall have a wireless remote controller to perform input functions necessary to operate the system. With the controller, a wireless receiver assembly must be furnished which shall be plug and fit compatible with the indoor unit.
 - b. The controller shall have a Power On/Off switch, Mode Selector – Cool, Dry, Heat, Auto, and Powerful Modes - Temperature Setting, Timer Control, Fan Speed Select and Horizontal and Vertical Vane control selector. There shall be an i-See® Sensor Area Selector control. The indoor unit shall perform Self-diagnostic Function and Check Mode switching. Temperature changes shall be in 1°F increments with a setting range of 61 to 88°F.
 - c. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.

B. Ducted Type:

1. Ducted type indoor units shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board, filter, and fan motor. The unit, in conjunction with the wired, wall mounted controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with nitrogen before shipment from the factory.
2. Unit Cabinet: The cabinet shall be space saving, low profile, horizontal, ducted type constructed of G-60 galvanized steel with factory applied foam surface insulation to prevent condensation on outer surfaces. The cabinet shall be provided with four mounting brackets to accommodate suspension from threaded rod or structural support located on the side panels in all four corners. Brackets shall be suitable for supporting the weight of the indoor unit. The indoor unit cabinet shall be equipped with a ducted air outlet and ducted rear return air connection.
3. Fan: The indoor fan unit shall be an assembly with two (2) or four (4) Sirocco fans direct driven by a single motor. Fan shall develop airflow to deliver up to 0.20 inches wg of external static pressure. The indoor fans shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. The indoor fans shall operate on any of three (3) speeds, High, Mid, and Low and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
 - a. Indoor unit sound level shall not exceed the levels below:

Tonnage	Low Speed	Mid Speed	High Speed
1	23 dB(A)	28 dB(A)	33 dB(A)
1.5	30 dB(A)	34 dB(A)	38 dB(A)
2	29 dB(A)	34 dB(A)	38 dB(A)
2.5	30 dB(A)	35 dB(A)	39 dB(A)
3	34 dB(A)	40 dB(A)	43 dB(A)
3.5	37 dB(A)	41 dB(A)	45 dB(A)

*****Choose Filter Option***:**

4. Filter: Return air shall be filtered by means of a 1" throwaway return air filter.
5. Filter: Install filter rack assembly with replaceable 2" pleated filters, filter access panels, and mounting connections for connection to ducted indoor unit.
6. Coil: The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan with two (2) drains shall be provided under the coil.
 - a. Both of the refrigerant lines between the indoor and outdoor unit shall be fully insulated.

*****Optional Condensate Pump***:**

- b. In addition to the two (2) gravity drains, the indoor unit shall be provided with an integral condensate lift mechanism able to raise drain water 18 inches above the condensate pan. Lift mechanism shall incorporate a safety sensor system to shut down the indoor fan and the compressor in the outdoor unit in the event of high level of condensate in the drain pan.
7. Electrical: The power to the indoor unit shall be supplied from the outdoor unit. The electrical power to the outdoor unit shall be 208 volts or 230 volts (see schedule), 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

8. System Control: The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit. The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. The control signal between the indoor and outdoor unit shall be a pulse signal 24 volts DC. Up to two wired controllers shall be able to be used to control one unit.
- a. A three (3) conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. A disconnect mounted near the indoor unit shall be provided by the Electrical Contractor.
 - b. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.
 - c. The indoor unit control board shall have auxiliary control contact connectors to provide switch, central control, and IP terminal.
 - d. The indoor unit shall be connected to a wall mounted wired controller to perform input functions necessary to operate the system. The wired controller shall have a liquid crystal display (LCD) presenting contents. The controller shall contain an On/Off button, Increase/Decrease Set Temperature buttons, a Heat/Cool/Auto/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Controller time clock function shall include a built-in weekly timer with up to eight pattern settings per day.
 - e. Temperature shall be displayed in Fahrenheit (°F). Temperature changes shall be by increments of 1°F within a range of 67°F to 87°F.
 - f. The wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), linear expansion valve (LEV) opening pulses, sub cooling and discharge super heat.
 - g. Normal operation of the wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room. The controller shall have the capability of controlling up to a maximum of sixteen systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet.
 - h. Control system shall provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.
 - i. Furnish unit with condensate drain pan level sensor to shutdown unit and prevent drain pan overflow.

C. Wall-Mounted Type

1. Indoor, wall-mounted unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit, in conjunction with the wired, wall mounted controller or wireless handheld controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.
2. Unit Cabinet: The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter. Cabinet color shall be white. The unit shall be wall mounted by means of a factory supplied, pre-drilled, mounting plate.
3. Fan: The indoor unit fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of three (3) speeds: Low, Mid, and Hi and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
 - a. Indoor unit sound level shall not exceed the levels below:

Tonnage	Low Speed	Mid Speed	High Speed
1	36 dB(A)	40 dB(A)	43 dB(A)
1.5	36 dB(A)	40 dB(A)	43 dB(A)
2	39 dB(A)	42 dB(A)	45 dB(A)
2.5	39 dB(A)	42 dB(A)	45 dB(A)
3	43 dB(A)	46 dB(A)	49 dB(A)

4. Vane: There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement.
5. Filter: Return air shall be filtered by means of an easily removable washable filter.
6. Coil: The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

*****Optional Condensate Pump***:**

7. Option: A condensate mini-pump shall be provided to provide a means of condensate disposal when a gravity drain is not available. Lift mechanism shall incorporate a safety sensor system to shut down the indoor fan and the compressor in the outdoor unit in the event of high level of condensate in the drain pan.
8. Electrical: The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the Mitsubishi Electric A-Control system. For A-Control, a three (3) conductor AWG-14 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.

9. System Control: The indoor unit shall be connected to a wall mounted wired controller to perform input functions necessary to operate the system. The wired controller shall have a large multi-language DOT liquid crystal display (LCD) presenting contents. There shall be a built-in weekly timer with up to eight pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Heat/Cool/Auto/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F). Temperature changes shall be by increments of 1°F with a range of 67°F to 87°F.
- a. The wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), LEV opening pulses, sub cooling and discharge super heat. Normal operation of the wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room. The controller shall have the capability of controlling up to a maximum of sixteen systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet (500 meters).
 - b. Control system shall provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.
 - c. Furnish unit with condensate drain pan level sensor to shutdown unit and prevent drain pan overflow.

*****OPTION: Wireless Remote Controller***:**

10. Optional wireless remote control
- a. The unit shall have a wireless remote controller to perform input functions necessary to operate the system. With the controller, a wireless receiver assembly must be furnished which shall be plug and fit compatible with the indoor unit.
 - b. The controller shall have a Power On/Off switch, Mode Selector – Cool, Dry, Heat, Auto, and Powerful Modes - Temperature Setting, Timer Control, Fan Speed Select and Horizontal and Vertical Vane control selector. The indoor unit shall perform Self-diagnostic Function and Check Mode switching. Temperature changes shall be in 1°F increments with a setting range of 61 to 88°F.
 - c. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.

D. Flush with Ceiling Recessed Cassette Type

1. Indoor units shall be flush with ceiling-recessed cassette type, factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, drain left mechanism, control circuit board, filter, fan, and fan motor. The unit, in conjunction with the wired, wall mounted controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with nitrogen before shipment from the factory.

2. Unit Cabinet: The cabinet shall be formed from galvanized sheet metal coated with high-density foam insulation. Cabinet shall be recessed mounted (flush with ceiling) and provided with four (4) corner mounting supports behind removable corner pockets in Grille assembly allowing adjustment of mounting height from front of unit.
 - a. The cabinet panel shall have provisions for a field installed filtered outside air intake.
 - b. There shall be a knock-out to provide a branch air duct for conditioning a secondary space.
 - c. There shall be an optional multi-function casement which will mount between the unit cabinet and the Grille assembly to provide a second field installed filtered outside air intake and provide a mount for a high-efficiency filter element.
 - d. A separate grill assembly shall be attached to the front of the cabinet to provide supply air vanes in four directions and a center mounted return air section. The four-way grill shall be fixed to bottom of cabinet allowing two, three or four-way blow. The grill vane angles shall be individually adjustable from the wired remote controller to customize the airflow pattern for the conditioned space. Grill assembly color shall be white.
3. Fan: The indoor fan shall be an assembly with a turbo fan propeller, direct driven by a single motor and shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. The indoor fan shall consist of five (5) speed settings, Low, Mid1, Mid2, High and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
4. Discharge Vanes: Indoor units shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow with switches that can be set to provide optimum airflow based on ceiling height and number of outlets used. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution. The vanes shall have an Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space.

*****Choose Filter Option***:**

5. Filter: Return air shall be filtered by means of 1" thick, washable filter.
6. Filter: Return air shall be filtered by means of an optional high-efficiency filter in the multi-function casement.
7. Coil
 - a. The indoor unit coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange.
 - b. The heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory.
 - c. A condensate pan with drain connections shall be provided under the coil. The unit shall also include a built-in, automatic condensate lift mechanism that will be able to raise drain water 33 inches (84 cm) above the condensate pan. The lift mechanism shall be equipped with a positive acting liquid level sensor to shut down the indoor unit if liquid level in the drain pan reached maximum level.

- d. Both of the refrigerant lines between the indoor unit and outdoor unit shall be fully insulated.
8. Electrical: The electrical power to the indoor unit shall be supplied from the outdoor unit. The power to the outdoor unit shall be 208 / 230 volts (see schedule), 1-phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The indoor unit shall be provided with A-Control – a system allowing the indoor unit to be powered and controlled directly from the outdoor unit using a fourteen (14) gauge (AWG) 3-wire connection plus ground wire providing both primary power and integrated , by-directional, digital control signal without additional connections.
9. System Control: The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit. The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Up to two wired controllers shall be able to be used to control one unit.
 - a. A three (3) conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. If code requires a disconnect mounted near the indoor unit, a TAZ-MS303 3-Pole Disconnect shall be used – all three conductors must be interrupted.
 - b. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.
 - c. The indoor unit control board shall have auxiliary control contact connectors to provide:
 - d. The indoor unit shall be connected to a wall mounted wired controller to perform input functions necessary to operate the system. The wired controller shall have a liquid crystal display (LCD) presenting contents. The controller shall contain an On/Off button, Increase/Decrease Set Temperature buttons, a Heat/Cool/Auto/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in Fahrenheit (°F). Temperature changes shall be by increments of 1°F within a range of 67°F to 87°F. Controller time clock function shall include a built-in weekly timer with up to eight pattern settings per day.
 - e. The wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), linear expansion valve (LEV) opening pulses, sub cooling and discharge super heat. Normal operation of the wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room. The controller shall have the capability of controlling up to a maximum of sixteen systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet.

- f. Control system shall provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.
- g. Furnish unit with condensate drain pan level sensor to shutdown unit and prevent drain pan overflow.

*****OPTION: Wireless Remote Controller***:**

- 10. Wireless Remote Controller
 - a. The unit shall have a wireless remote controller to perform input functions necessary to operate the system. With the controller, a wireless receiver assembly must be furnished which shall be plug and fit compatible with the indoor unit.
 - b. The controller shall have a Power On/Off switch, Mode Selector – Cool, Dry, Heat, Auto, and Powerful Modes - Temperature Setting, Timer Control, Fan Speed Select and Horizontal and Vertical Vane control selector. The indoor unit shall perform Self-diagnostic Function and Check Mode switching. Temperature changes shall be in 1°F increments with a setting range of 61 to 88°F.
 - c. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.

2.04 OUTDOOR AIR-COOLED CONDENSING UNITS

- A. Condensing units shall be factory-assembled and tested, air-cooled, horizontal discharge type, consisting of compressor, condenser coil, fan, motor, refrigerant reservoir and operating controls.
- B. Casing shall be zinc coated steel finished with baked enamel, complete with removable panels for access to controls and mounting holes in base. Unit shall be complete with flare fittings on exterior of casing. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.
- C. Compressor:
 - 1. Compressors shall be hermetically sealed, with built-in overloads and vibration isolation.
 - 2. The compressor for 1 to 3-ton units shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology. The compressor for 3-ton units shall be a Frame Compliant Scroll compressor with Variable Speed Inverter Drive Technology.
 - 3. The compressor shall be driven by the inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings.
 - 4. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
 - 5. The outdoor condensing unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.
- D. Condenser coils:

1. The L-shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
 2. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor controlled step motor.
- E. Aluminum propeller fan shall be direct-driven with permanently lubricated or ball-bearing fan motor having thermal overload protection.
- F. Furnish unit with wind baffle accessory for low ambient cooling down to 0°F outdoor air temperature.
- G. Refrigerant charge: R-410A.
- H. The outdoor unit shall be compatible with the indoor unit and shall be of the same capacity and same manufacturer as the indoor unit.
- I. The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions.
- J. System shall operate at up to a maximum refrigerant tubing length of 100 feet for the 1-1.5-ton units and 165 feet for the 2-3.5-ton units between indoor and outdoor units without the need for line size changes, traps or additional oil. 1 to 3-ton units shall be pre-charged to accommodate a maximum of 70 feet of refrigerant tubing; 3.5-ton units shall be pre-charged for 100 feet.
- K. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
- L. The outdoor unit shall be able to operate with a maximum height difference of 100 feet between indoor and outdoor units.
- M. Outdoor unit sound level shall not exceed:

Tonnage	Cooling
1	46 dB(A)
1.5	46 dB(A)
2	48 dB(A)
2.5	48 dB(A)
3	48 dB(A)
3.5	51 dB(A)

- N. Electrical
1. The electrical power of the unit shall be 208volts or 230 volts (see schedule), single phase, 60 hertz.
 2. Power for the indoor unit shall be supplied from the outdoor unit.
 3. The outdoor unit shall be controlled by the microprocessor located in the indoor unit.
 4. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.
 5. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

2.05 UNIT CONTROLS

- A. The control system shall consist of two microprocessors, one on each indoor and outdoor unit, interconnected by a single, non-polar two-wire cable. The system shall have self-diagnostics ability and shall be capable of automatic restart when power is restored after power interruption. The indoor unit shall be connected to a wall-mounted wired controller via 12VDC monitoring set temperature, room temperature, and compressor operation conditions. The control signal between the indoor and outdoor units shall be 24VDC.

PART 3 EXECUTION

3.01 GENERAL

- A. All equipment shall be installed plumb and level, in locations indicated and in accordance with the equipment manufacturer's recommendations.
- B. All equipment shall be installed with adequate clearance provided for proper operation and routine maintenance and servicing.

3.02 DELIVERY, STORAGE AND HANDLING

- A. Handle split DX air conditioning units and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged terminal units or components; replace with new.
- B. Store split DX air conditioning units and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading DX split air conditioning units and moving them to final location.

3.03 TESTING, CHARGING AND STARTUP

- A. Test refrigerant piping system in accordance with Section 231040 "Refrigeration Piping".
- B. Evacuate and charge system with refrigerant as required to place equipment in operation. Provide full operating charge.
- C. Start-up, test, and adjust equipment in accordance with manufacturer's published start-up instructions. Verify proper line and manifold gas pressure. Check and calibrate controls.

END OF SECTION 23 81 10

**SECTION 23 09 00
INSTRUMENTATION AND CONTROL FOR HVAC**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
 - 1. 23 01 10 – Project Submittal Requirements
 - 2. 23 02 10 – Owner Operating and Maintenance Training
 - 3. 23 03 50 – Commissioning of Mechanical Systems and Components
 - 4. 23 09 40 – Wire and Cable
 - 5. 23 09 41 – Conduit Systems
 - 6. 23 09 42 – Pulling Cables
 - 7. 23 09 93 – Sequences of Operation

1.03 DEFINITIONS

- A. The following acronyms are repeatedly used within this document.

AAC – Advanced Application Controller	JACE – Java Application Control Engine
AFF – Above Finished Floor	LAN – Local Area Network
AHU – Air Handling Unit	MAU – Makeup Air Unit
ASC – Application Specific Controller	MSTP – Master-Slave/Token Passing
AWS – Advanced Work Station	NC – Network Controller
BACnet – Building Automation Control Network	O&M – Operation and Maintenance
BAS – Building Automation System	PCU – Programmable Control Unit
BBMD – BACnet/IP Broadcast Management Device	PIC – Protocol Implementation Conformance
BIBB – BACnet Interoperability Building Block	PID – Proportional, Integral, Derivative
BTL – BACnet Testing Laboratories	PROM – Programmable Read-Only Memory
CAV – Constant Air Volume	RAM – Random Access Memory
CCO – Contractor's Check Out	RCD – Remote Communication Device
COV – Change of Value	RH – Relative Humidity
CUH – Cabinet Unit Heater	RTU – Rooftop Unit
DDC – Direct Digital Control	SAML – Security Assertion Markup Language
DLN – Device Level Network	SD – Smart Device
EEPROM – Electronically Erasable Programmable Read-Only Memory	SRAM – Static Random Access Memory
EPROM – Erasable Programmable Read-Only Memory	TCP – Technical Certification Program
FAC LAN – Facility Local Area Network	UDP – User Datagram Protocol
FCU – Fan Coil Unit	UPS – Uninterrupted Power Supply
GB – Gigabyte	VAC – Volts Alternating Current
HVAC – Heating Ventilation and Air Conditioning	VAV – Variable Air Volume
I/O – Input / Output	VDC – Volts Direct Current
IAS – Internet Authentication Service	VPN – Virtual Private Network
IP – Internet Protocol	WLN – Wide Area Network

1.04 SCOPE OF WORK

- A. This project requires the expansion of an existing or installation of a new Building Automation System constructed using the Tridium Niagara 4 Framework with BACnet Field Level Devices. The Contractor shall implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide security, flexibility for expansion, maintenance, and serviceability of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project. The BAS shall utilize Niagara 4 JACE 8000 controller(s) networked with Niagara 4 Web Supervisor(s). Only Tridium Niagara 4 Framework based products are acceptable for the Network Controllers and Servers. ASC and PCU may be manufacturer specific as long as they are BTL certified and support IP and/or MSTP communications.
- B. It is the Owner's intent to purchase an open system capable of being serviced and expanded by any acceptable system integrator that has and maintains certification (TCP) to work on Niagara 4 Framework systems. The Niagara Compatibility Statement (NICS) for all Niagara Software shall allow open access and be set as follows: `accept.station.in="" accept.station.out="" accept.wb.out="" accept.wb.in=""`. In any case, the Owner shall maintain the right to direct contractor to modify any software license, regardless of supplier, as desired. The Contractor shall not install any "brand specific" software, applications, or utilities on Niagara 4 Framework based devices.
- C. All hardware and field level devices (i.e. NCs, ASCs, PCUs) installed for the project shall not be limited in their ability to communicate with a specific brand of Niagara 4 Framework device. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed in replace of or in parallel with existing components.
- D. The system shall be accessible through an existing remote accessed browser based operator workstation.
- E. Any and all changes occurring to the existing BAS systems in the facilities shall be coordinated with the Owner.
- F. All installations near any existing controllers shall be reviewed with the Owner and Planning/Design team to ensure that the installation corresponds with future planning and upgrades.
- G. The BAS Contractor is responsible for the repair of all finished surfaces effected as a result of BAS related installation work. This includes, but is not limited to, carpet, drywall, paint, ceiling tiles, furniture, and the like.
- H. The Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job-specific software code, databases, and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NC(s), Server(s), PCU(s) and ASC(s). Any and all required passphrases, usernames, and passwords for admin and programming level access to any component or software program shall be provided to the Owner.
- I. The BAS Contractor shall provide all documents called out in these specifications including, but not limited to, submittals, O&M manuals, commissioning submittals, CAD based as-built documentation, and training manuals. Provide electronic files on secure electronic media or secure file sharing service.
- J. The BAS Contractor is responsible for training facility personnel on the operation and maintenance of the system.
- K. The Contractor will be required to perform the following:

1. Furnish, install, configure, and commission a new Niagara 4 Framework with BACnet programmable and application specific DDC controllers for the equipment identified in the BAS drawings, including all components, software, and applications required to meet the sequence of operation and the design/performance intent of the systems; Air Handling Units (AHUs), Rooftop Units (RTUs), Boilers, Chillers, Variable Air Volume Units (VAVs), Cabinet Unit Heaters (CUHs), Fan Coil Units (FCUs), etc.
 2. Provide Application Specific Controllers (ASCs) and Programmable Control Units (PCUs) as specified herein and as indicated on the BAS drawings. Provide I/O and ancillary devices as specified herein, as indicated on the BAS drawings, and as necessary to perform the sequences of operation. Provide BACnet or Niagara 4 Framework certified products that communicate on IP or MSTP channels to meet the functional specifications.
 3. Provide BACnet BTL AWS (Advanced Work Station) certification for the BAS Servers. Tridium Niagara 4 JACE 8000 Network Controllers (NCs) shall be BTL BBC certified.
 4. Furnish and install all low voltage step-down transformers with associated low voltage connections, power supplies, and power/communication/input/output cabling necessary for the control system.
 5. Furnish and install conduit, junction boxes, fittings, panels, enclosures, and hardware as specified in these specifications, on the drawings, and as required by Code. The JACE Network Controllers shall be install in a cabinet in a secure area inaccessible to the general public.
 6. Furnish and install all wiring required for a complete system, including communication bus, analog points, digital points, low voltage power, emergency power, and spare communication bus. Splices are not permitted within the BAS LAN or BACnet communication cables. Only continuous bus topologies, MS/TP, or continuous homeruns are allowed for these networks. Capacity of any bus shall be limited to 80% of the allowable device count to allow for future minor modifications or expansions to the network.
 7. Provide system point-to-point check out, verification, and documentation. The BAS contractor shall assist Commissioning agent when applicable and/or a Test and Balance Firm in verification and functional performance testing and graphics acceptance testing.
- L. It is the intent of the Owner to maintain strict standards for configuration, graphics, trends, alarms, devices, and points for the entire BAS. Please reference any and all Owner standards provided as part of the bid package and project.
- M. It is the contractor's responsibility to review all of the design documents and specifications and report any discrepancies to the Engineer or Owner.

1.05 DIVISION OF WORK

A. General

1. Certain BACnet products, systems, and interface devices may be provided by other trades. Examine the Contract Documents to ascertain the requirements to install, wire, program, commission, and/or interface to these systems. Particular attention must be paid towards the interface boards submitted by the various equipment providers. It is the Contractor's responsibility to verify the submitted interfaces will integrate properly into the BAS. Report any discrepancies to the Owner.
2. Wherever work interconnects with work of other trades, coordinate with other trades and with the Owner to ensure that all trades have the information necessary so that they may properly install all the necessary connections and equipment to ensure a fully functioning and complete BAS.

B. Building Automation System (BAS) Contractor Responsibilities:

1. The BAS Contractor will provide a fully integrated and fully programmable BACnet building automation system (BAS), UL listed (UL916 and UL864), incorporating direct digital control (DDC) for energy management, equipment monitoring, and control. A UL864 listing shall be required for all controllers that are utilized in a smoke control sequence and as necessary to meet or exceed all national and local codes. In addition, UL864 devices and non-UL864 shall not be permitted on the same network segment unless the devices are separated with a UL864 Ethernet switch. All MS/TP network segments shall be consistent with its UL864 or non-UL864 implementation. Coordinate closely with the Construction Manager and Engineer the portions of the BAS system that will require UL864 listing.
2. The BAS Contractor will provide all required devices, sensors, wiring, programming, setup, and alarms for all inputs identified in the specification. The BAS Contractor shall include all hardware, software, and programming not specifically itemized in these specifications, which is necessary to implement, maintain, operate, and diagnose the system in compliance with these specifications and which is necessary to provide a complete and operable DDC system.
3. The BAS Contractor shall be responsible for all electrical work associated with the BAS control system and as called for on the Drawings, including all 120V devices not specifically called for on the Electrical Drawings which are required for a complete BAS system. This BAS control wiring shall be furnished and installed in accordance with the Electrical requirements as specified in Division 26, the National Electric Code, and all applicable local codes.
4. The successful BAS Contractor will be responsible for providing all pertinent information to the BAS Integrator, including the BACnet object listings per panel, all intrinsic or algorithmic alarm settings, all trend log information, a detailed list of control points, all setpoints, and all point ranges. The work performed by the BAS Integrator does not alleviate the BAS Contractor's responsibility to provide BACnet alarming or trending functionality. The successful BAS Contractor must support all facets of interoperability as identified in the BACnet conformance section.

C. BAS Integrator Responsibilities:

1. The BAS Integrator shall provide custom graphic displays, complete alarm and event management, and standardized trending for new HVAC systems onto the existing BACnet Server.
 - a. The BAS Integrator will compile, manage, and present the data in the Owner's standard format.

D. HVAC Contractor Responsibilities:

1. The HVAC Contractor shall provide all wells and openings for water and air monitoring devices. Temperature sensors, flow switches, and alarms furnished by BAS Contractor.

E. Electrical Contractor Responsibilities:

1. The Electrical Contractor shall provide dedicated 120 volt, 20 amp circuits, and circuit breakers from emergency power panel for each required DDC Controller. Run power circuit to junction box near controllers installed and/or as final connection to controllers shown on Electrical Drawings by BAS Contractor.
2. The Electrical contractor will also provide smoke detector and smoke damper interlock and power wiring for all life safety applications.

- F. The demarcation of work and responsibilities between the BAS Contractor and other related trades shall be as outlined in the Responsibility Matrix herein. This matrix is not intended to relieve the HVAC Contractor of the obligation to assure the complete execution of any work for which responsibility is assigned to the BAS Contractor, when the BAS Contractor is a sub-contractor to the HVAC Contractor.
1. Key:
 - a. BAS = Building Automation System Contractor
 - b. P = Plumbing Contractor
 - c. H = HVAC Contractor
 - d. E = Electrical Contractor
 - e. EP = Power for the device controls is provided by means internal to the device. Control power is provided from the power circuit to the device, which is the responsibility of the Electrical Contractor.
 - f. Wiring Note: Power wiring by "BAS" indicates that the BAS Contractor is responsible for extending power from a junction box or source, which has been provided by the Electrical Contractor, to a device or through a transformer to low voltage system. Transformer is to be provided by the BAS Contractor.

Responsibility Matrix					
Work		Furnish	Install	Low Volt. Wiring/Tube	Line Power
1	BAS Low Voltage and Communication Wiring* ¹ (Note 1)	BAS	BAS	BAS	N/A
2	VAV Box Controller (Note 2)	BAS	H* ²	BAS	E
3	BAS Conduits, Raceway, Wiring, Enclosures, and Panels	BAS	BAS	BAS	BAS
4	Conduit Sleeves for BAS Penetrations thru Masonry, Concrete Walls/Floors, Etc.	BAS	BAS	N/A	N/A
5	Automatic Dampers (Non Factory)	BAS	H	N/A	N/A
6	Automatic Valves	BAS	H	BAS	N/A
7	VAV Boxes	H	H	N/A	N/A
8	DDC Controllers	BAS	BAS	BAS	E
9	Pipe Insertion Devices and Taps Including Thermowells, Flow and Pressure Stations.	BAS	H	BAS	BAS
10	BAS Current Switches.	BAS	BAS	BAS	N/A
11	BAS Control Relays	BAS	BAS	BAS	N/A
12	Power Distribution System Monitoring Interfaces	E	E	BAS	E
13	Concrete and/or Inertia Equipment Pads and Seismic Bracing	H	H	N/A	N/A
14	BAS Interface with Chiller Controls	BAS	BAS	BAS	BAS
15	Chiller Controls Interface with BAS	H	H	BAS	E
16	Elect. Baseboard Heating Control (Note 3)	H	E* ³	N/A* ³	E
17	All BAS Nodes, Equipment, Housings, Enclosures and Panels.	BAS	BAS	BAS	BAS
18	Smoke Detectors (Note 4)	E	E	E/ BAS * ⁴	E
19	Fire/Smoke Dampers (Note 5)	H	H	BAS* ⁵	E
20	Fire Dampers	H	H	N/A	N/A
21	Chiller Flow Switches	H	H	BAS	N/A
22	Boiler Wiring	H	H	H	H
23	Water Treatment System	H	H	H	E
24	Variable Frequency Drives	BAS	E	BAS	E
25	Refrigerant Monitors	BAS	BAS	BAS	E

Responsibility Matrix					
Work		Furnish	Install	Low Volt. Wiring/Tube	Line Power
26	Computer Room A/C Unit Field-Mounted Controls	H	H	BAS	E
27	Fire Alarm Shutdown Relay Interlock Wiring	E	E	E	E
28	Fire Alarm Smoke Control Relay Interlock Wiring	E	E	BAS	E
29	Fireman's Smoke Control Override Panel	E	E	E	E
30	Fan Coil Unit Controls	BAS	BAS	BAS	E
31	Cabinet/Unit Heater Controls (Note 6)	BAS/ H*6	E/ BAS*6	BAS	E
32	Packaged RTU Space Mounted Controls	H	BAS	BAS	E
33	Packaged RTU Factory-Mounted Controls	H	H	BAS	E
34	Packaged RTU Field-Mounted Controls	BAS	BAS	BAS	E
35	Cooling Tower Vibration Switches	H	H	E	E
36	Cooling Tower Level Control Devices	H	H	E	E
37	Cooling Tower Makeup Water Control Devices	H	H	E	E
38	Starters, HOA Switches	E	E	N/A	E
39	Control Damper Actuators	BAS	BAS	BAS	E
40	LV Lighting Control Relays and Switches	E	E	E	E
41	Addressable Lighting Control Modules and Panels	E	E	E	E
42	Photo and Occupancy Sensors	E	E	E	E
43	Operable Lighting Breaker Panels	E	E	E	E

Footnotes:

- *1. BAS low voltage and communications wiring: BAS Ethernet communications cable and IP infrastructure furnish and install by BAS Contractor or Division 26 Electrical Contractor as per options in Row #1 of the BAS Responsibility Matrix above.
- *2. VAV box controller factory installation would normally be by Division 23 Mechanical who furnishes the VAV boxes; could be by BAS for field installation of special controllers, see Row #2 of the BAS Responsibility Matrix above.
- *3. Electric Baseboard Heating Controls – for line voltage stand-alone controls: furnished by Division 23 Mechanical Contractor who furnishes the baseboard units; line voltage controls installed and connected by Division 26 Electrical Contractor. Alternately, controls may be furnished and installed by BAS Contractors for projects requiring Baseboard Heating controls to be integrated into the BAS.

- *4. Smoke Detector also wired to shut down AHU/HVAC by BAS Contractor. Duct smoke detectors and fire alarm control modules shall be provided by others. Provide wiring, conduit, and necessary interface with fire alarm system to perform specified sequence of operation.
- *5. Fire/Smoke Dampers: BAS Contractor to provide and ensure OPEN/CLOSE control of Fire/Smoke dampers as coordinated between BAS HVAC systems sequences, controls and overrides, and the Fire Alarm system control status priorities and overrides. Coordinate with Division 26 to provide duct detectors or fire alarm control modules for air handling unit and exhaust system shutdown and smoke control inputs to the DDC system. In most cases fire alarm control modules will be the most effective and flexible way of achieving this interface. Ensure that the logic matrix for the fire alarm devices to trigger a HVAC response is clearly specified.
- *6. Cabinet/Unit Heater Controls – for line voltage stand-alone controls: furnished by Division 23 Mechanical Contractor who furnishes the Cabinet/Unit Heaters; line voltage stand-alone controls installed and connected by Division 26 Electrical Contractor.

1.06 SEQUENCES OF OPERATION

- A. Program each Niagara Framework 4 JACE Network Controller, and third party ASC, PCU, device, etc., to perform the sequences of operation provided on the construction documents. Provide all necessary hardware on each piece of equipment in order for the equipment to perform the specified sequence and to meet the requirements of the point lists.
- B. The Contractor shall be responsible for all control wiring connections, auxiliary devices, and control wiring diagrams to complete the control system and attain the described sequence of operation.

1.07 QUALITY ASSURANCE

- A. Installer's Qualifications: The Contractor shall be fully certified and have a successful history in the design, installation, and customization of Niagara 4 Framework based Integrated Building Automation Systems to provide web browser based monitoring and control of BACnet field level devices. Contractor must demonstrate experience in BAS installations for not less than 3 years and in DDC installation projects with point counts equal to this Project and systems of the same character as this Project.
- B. Installer's Experience with Proposed Product Line: Firms shall be specialized in and be experienced with the installation of the proposed product line for not less than one year from date of final completion on at least three (3) projects of similar size and complexity. Submittals shall document this experience with references. Provide evidence of Niagara TCP certification as part of the submittal process.
- C. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- D. The BAS must be supplied and installed by the same Control Contractor. Only Factory Authorized Distributors will be considered for installation. The letting of separate contracts by the prime HVAC Contractor for the Control System and a separate contract for its installation by a third party installer is strictly prohibited.
- E. Design and build all system components to be fault-tolerant.
 - 1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3-Hertz variation in line frequency.
 - 2. Static, transient, and short-circuit protection on all inputs and outputs.
 - 3. Protect communication lines against incorrect wiring, static transients, and induced magnetic interference.
 - 4. Network-connected devices to be AC-coupled or equivalent so that any single device failure will not disrupt or halt network communication.

5. All Building / System Controllers shall have real time clocks and data file RAM with battery and SRAM backup.
 6. All controllers shall be EEPROM, flash driven.
- F. The BAS Contractor shall have a competent and factory certified Project Manager who is able to answer field questions, is aware of all schedules and schedule changes, and is responsible for the BAS Contractor's work and the coordination of their work with all other trades. This Project Manager shall be available on-site and shall respond to design, programming, and equipment related questions. Failure to provide the above services shall be considered a breach of Contract Documents.
- G. Codes and Standards:
1. Comply with all current codes, ordinances, regulations, and Owner requirements.
 2. All microprocessor based control products used shall conform to BTL Certified Standards, and/or Niagara 4 Framework.
 3. All electronic equipment shall conform to the requirements of FCC Regulations, Part 15, Subpart B, Class A, governing radio frequency electromagnetic interference, and be so labeled.
 4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 5. BAS shall comply with and be listed at time of bid for the following Underwriters Laboratories Standards:
 - a. UL 916 for Energy Management Equipment, per category PAZX for Energy Management Equipment.
 - b. UL 864 for Control Units for Fire-Protective Signaling Systems, per category UUKL for Smoke Control System Equipment.
 6. Comply with ASHRAE 135 for DDC system components.
 - a. Product shall be ISO 9001 Registered at the time of bid.
 7. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

1.08 SUBMITTALS

- A. Shop Drawings:
1. Provide Shop Drawings per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
1. Provide manuals per requirements of Section 23 01 10.
- C. Record Drawings:
1. Provide record drawings per the requirements of Section 23 01 10.
 2. Provide record copies of product data and control Shop Drawings updated to reflect the final installed condition.
 3. Accurately record actual set points, settings of controls, and final sequence of operation, including changes to programs made after submission and approval of Shop Drawings and including changes to programs made during specified testing.
 4. Record copies shall include individual floor plans with device (controllers, routers, sensors, etc.) locations and all interconnecting wiring routing, including space sensors, LAN wiring, power wiring, and low voltage power wiring.

- D. Product Data:
1. Submit manufacturer's technical product data for each Niagara 4 Framework based Network Controller, control device, sensor, actuator, relay, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation and start-up instructions.
 2. As part of the submittal, provide an accurate parts list including manufacturer, model number, and quantity for all hardware and software.
 - a. Submit documentation indicating NICs and/or BTL compliance and include Protocol Implementation Conformance (PIC) Statements.
 3. Submit Shop Drawings for each control system.
 - a. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 - b. Wiring diagrams showing power, signal, and control wiring.
 - c. Details of control panel faces including controls, instruments, and labeling.
 - 1). Schedule of valves including flow characteristics.
 - d. Schedule of control dampers including performance characteristics.
 4. Control Logic Documentation:
 - a. Provide a written description of each control sequence.
 - b. Include control response, settings, set points, throttling ranges, gains, reset schedules, adjustable parameters and limits as part of as-built documentation.
- E. Submit a BAS Start-Up Test Agenda and Schedule for review and approval.

1.09 SYSTEM ARCHITECTURE

- A. The system provided shall incorporate hardware and software resources sufficient to meet the functional requirements of these Specifications. The Facility Local Area Network (FAC LAN) and Device Level Network (DLN) shall be based on industry standard open platforms as specified herein and utilize commonly available operation, management, and application software. All software packages and databases shall be licensed to the Owner to allow unrestricted maintenance and operation of the BAS. Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.
- B. The system architecture shall expand on the existing or implement a new building BAS which is based on the Niagara 4 Framework and consists of an Ethernet-based, wide area network (WAN), a single Local Area Network (LAN) that supports NCs, PCUs, ASCs, Operator Workstations (OWS), Smart Devices (SD), and Remote Communication Devices (RCDs) as applicable.
1. WAN: The WAN shall be an Internet-based network connecting multiple facilities with a central data warehouse and server, accessible via standard web-browser. This is an existing infrastructure and Contractor is not required to configure any components of this WAN. (Owner Provided and Managed)
 2. Facility Local Area Network (FAC LAN): The FAC LAN shall be an Ethernet-based, 10/100/1000 Ethernet LAN connecting Local NCs, IAS Server, and OWSs. The FAC LAN serves as the backbone for the NCs communications path and as the connection point to the WAN. LAN shall be IEEE 802.3 Ethernet over Fiber or Category 6 cable with switches and routers that support 1000base-T gigabit Ethernet throughput. (Owner Provided and Managed)

3. Device Level Network (DLN): The DLN shall be a network used to connect PCUs and ASCs. These shall be IP or MSTP devices as defined in the BACnet BTL standard. Network speed shall be a minimum of 38.4K BACnet MSTP.
 4. ARCnet and/or Token-Ring based FAC LANs and DLNs shall **NOT** be acceptable.
- C. Remote Data Access: The system shall support Browser-based remote access to the building data. The BAS contractor shall coordinate with the Owner's IT department to ensure all remote browser access (if desired by the Owner) is protected with the latest Niagara 4 Software updates and a VPN (Virtual Private Network) which is Owner provided and managed.
 - D. Browser-based access: A remote/local user using a standard browser will be able to access all control system facilities and graphics via a SAML authenticated connection. Only native Internet browser-based user interfaces that do not require plug-ins (thin clients) are acceptable. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Microsoft Edge™, Firefox™, or Chrome™.
 - E. The communication speed between the controllers, LAN interface devices, servers, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition.
 - F. Niagara 4 Framework Systems Web Supervisor(s): Server that maintains the systems configuration and programming database. It shall allow secure multiple-access to the control information. Server hardware is Owner provided and maintained.
 - G. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on a server that resides on the FAC LAN. User tools for DLN and FAC LAN management shall be provided and licensed to the Owner and shall allow unrestricted configuring, updating, maintaining, and expanding of all current devices, configurations, and settings.
 - H. Database Schema shall be published and provided to the Owner to facilitate easy access to DLN and FAC LAN data.

1.10 BACNET CONFORMANCE AND COMMUNICATIONS

- A. All installations shall be BACnet for each level of new controller that is installed. Each controller shall be "native" BACnet in that there should be no converters from proprietary to BACnet language outside of the controller.
- B. The Building Automation System (BAS) contractor shall supply a BACnet (ANSI/ASHRAE 135-2004) compliant system. Each device category and its required compliance are listed below. BACnet compatible systems that employ the use of proprietary 'gateways' will not be accepted unless otherwise noted.
- C. All BACnet installations using BACnet/IP Broadcast Management Device (BBMD) for their area subnet applications shall follow these standards. This BBMD shall come from a newly supplied BBMD controller specifically included in the new installation for that newly created subnet. The BBMD shall be a controller which is a zero node controller (containing no physical I/O points) solely installed and maintained in the subnet for routing all BACnet traffic for the entire subnet.
- D. All BACnet installations, including 3rd party equipment, shall be managed by one of the Owner approved BAS Contractors or by deviation request. It is the requirement of the BAS Contractor to provide BACnet Instance ID numbers and Network numbers that are appropriate within their assigned range. All third party equipment shall be integrated with BACnet. This may be done MS/TP or TCP/IP where it makes sense to implement either. In the event that BACnet is not available with the third party equipment, it may be implemented in Modbus RTU or TCP as appropriate.
- E. All controllers shall be BACnet IP or MS/TP. They shall not operate on proprietary languages.
- F. MS/TP controllers from the approved BAS vendors may not be intermixed on MS/TP networks. All controllers installed must be accessible from the front end software for controller level changes, such as programming, schedules, point database management, etc.

- G. "Enhanced" BACnet MS/TP schemes may be used as long as the information leaving the "proprietary system" on the IP level may be accessed as BACnet compliant traffic that may be received and used by other systems.
- H. The Network numbers and Instance ID's are to be managed by the BAS Contractor and an updated vendor specific spreadsheet must be submitted to the Owner with all of the vendor's Instance ID numbers whenever an addition or change is made to existing BACnet system.
- I. Each control system manufacturer shall operate on their own BACnet UDP Port:
 - 1. Tridium 47808
 - 2. Delta 47809
 - 3. Siemens 47810
 - 4. Johnson Controls 47811
 - 5. Trane 47812
 - 6. Honeywell 47813
 - 7. Distech 47814
- J. The BACnet system shall be capable of Internet Protocol (IP) communications. BACnet/IP or Annex J will be considered the basis of design.
- K. The primary Local Area Network (LAN) shall be based upon the ISO 8802-3 Ethernet standard and will be required for all Network Controllers and System Controllers. The use of MS/TP communications for interconnecting the said devices is strictly prohibited. The installation of all Ethernet wiring, accessories, and connectors shall conform to the ISO standard and/or guidelines identified herein. The connection media shall be Category 6A, Unshielded Twisted Pair (UTP) wire. The maximum single network run shall not exceed more than 90 meters. The BAS system may utilize the customer's Local Area Network (LAN) provided the bandwidth consumption is less than 10% of the total network bandwidth. Under no circumstances, shall the customer's LAN be subject to failure and/or abuse. In efforts to decrease liability, all BACnet devices that reside on the LAN must support the BACnet Broadcast Management Device (BBMD) scheme. Multi-casting or Global broadcasting will not be permitted without the use of a BBMD. The BAS Integrator has provided the BBMD device for every building. The BAS Contractor shall coordinate with the Owner and the BAS Integrator for their controllers to reside on the building level network supported by the BBMD. The Owner's network has been segmented so that each building will be a separate subnet from all others.
- L. The secondary or sub-network shall utilize the Master-Slave/Token-Passing protocol, as acknowledged by the ANSI/ASHRAE 135 standard. Proprietary RS-485 or equivalent links will not be considered unless otherwise noted. The MS/TP link shall operate at a 76.8 Kbps minimum and utilize no more than 2 repeaters in any instance. Multi-channel repeaters will not be permitted.
- M. The use of proprietary gateways to transmit input/output data and/or related information must reside on the Ethernet LAN and be approved, in writing, prior to the bid.
- N. Network Controller Conformance: The new network controllers must be certified and listed by BTL (BACnet Testing Laboratory) under Device Profile B-BC (Annex L of the BACnet standard).
- O. Advanced Application Controller Conformance (AAC): The new AAC's must be certified and listed by BTL (BACnet Testing Laboratory) under Device Profile B-AAC (Annex L of the BACnet standard).
- P. Application Specific Controllers Conformance (ASC): The new ASC's must be certified and listed by BTL (BACnet Testing Laboratory) under Device Profile B-ASC (Annex L of the BACnet standard).

- Q. Read / Write Properties: The entire BACnet BAS system (all OWS, Network Controllers, AAC, and ASC devices) shall support the Read/Write properties within the given BACnet objects necessary for proper operation, and shall permit dynamic creation and deletion thereof.

1.11 SUBSTITUTIONS

- A. Wherever the words “for review” or “for acceptance” are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of apparatus for that specified, submit all information pertinent to the adequacy and adaptability of the proposed apparatus to the Owner and secure their approval before the apparatus is ordered. Refer to general condition requirements for substitutions.

1.12 PRODUCT DELIVERY, STORAGE, HANDLING, PROTECTION, AND CLEANING

- A. All products and materials shall be new, clean, and free of defects, damage, and corrosion.
- B. Ship and store products and materials in a manner which will protect them from damage, weather, and entry of debris until final acceptance.
- C. Where control devices are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

1.13 WARRANTY

- A. The entire BAS and all ancillary equipment required for its operation shall be free from defects in workmanship and material under normal use and service. If within 12 months from the date of substantial completion the installed equipment is found to be defective in operation, workmanship, or materials, the Contractor shall replace, repair, or adjust the defect at no cost to the Owner.
- B. The warranty period for work and systems of this project shall commence after written notification of Owner’s final acceptance.
- C. Corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.
- D. The Owner reserves the right to make changes to the BAS during the Warranty Period. Such changes do not constitute a waiver of warranty. Contractor shall warrant parts and installation work regardless of any such changes made by Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.
- E. At no cost to the Owner, during the Warranty Period, Contractor shall provide maintenance services for software including all current software updates, firmware, and hardware products. Prior to the closeout of the warranty period, the BAS contractor shall meet with the Owner’s representative to address any questions or concerns and offer ongoing Software Maintenance Services to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Materials shall be new, the best of their respective kinds without imperfections or blemishes, and shall not be damaged in any way. Used equipment shall not be used in any way for the permanent installation except where Drawings or Specifications specifically allow existing materials to remain in place.
- C. The Contractor shall furnish and install single controllers with the physical and software resource count for standalone operation of each piece of equipment (e.g. AHU, RTU, Plants, VAV, etc.). The sequence of operation and required points for control shall reside on a single controller. Remote I/O modules or Expansion I/O modules plugged directly into the controller may be utilized for expansion.

2.02 UNIFORMITY

- A. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer

2.03 ACCEPTABLE MANUFACTURERS

- A. BAS Server Software
 - 1. Tridium Niagara 4 Framework Web Supervisor
- B. Network Controllers
 - 1. Tridium
 - 2. Vykon
 - 3. Delta
 - 4. Siemens
 - 5. Johnson Controls
 - 6. Honeywell
 - 7. KMC
 - 8. Schneider Electric
 - 9. Automated Logic
- C. Advanced Application Controllers and Application Specific Controllers
 - 1. Tridium
 - 2. Vykon
 - 3. Delta Controls, Inc.
 - 4. Siemens
 - 5. Johnson Controls
 - 6. Honeywell
 - 7. KMC
 - 8. Schneider Electric
 - 9. Automated Logic
 - 10. Distech
 - 11. Trane

2.04 BAS SERVER SOFTWARE

- A. Platform Requirements
 - 1. Hardware
 - a. Dual or Quad Core x64 Processor (Quad Core Xeon or better preferred for Web Sup)
 - b. 8GB Ram
 - c. 20 GB HDD
 - d. 1080p Display
 - e. 10/100 MD Ethernet Card
 - 2. Operating System
 - a. Windows 10 (64 bit)

- b. Windows Server 2016
 - c. Windows Server 2019 (64 bit)
 - d. Red Hat Linux Enterprise 7.7 or 8.1 (64 bit)
3. Browser
- a. Chrome, Firefox, or Microsoft Edge
4. Database
- a. MySQL 5.7, 8.0, 9.0
 - b. Oracle Express 11g
 - c. Oracle 12, 18, 19c
 - d. MSSQL 2012, 2016, 2017, 2019

2.05 NETWORKING COMMUNICATIONS

- A. The design of the BAS network shall integrate stand-alone DDC Controllers on a peer-to-peer communications network, and other devices on other networks. The network architecture shall consist of the following levels:
- 1. A facility-wide Ethernet communications network based on the BACnet/IP protocol (Annex J.)
 - 2. A building-wide peer-to-peer communications network between Network Controllers utilizing the BACnet protocol over Ethernet. If this specification requirement cannot be met, the manufacturer must identify how building-wide peer-to-peer communication will occur and how it will affect the Owner's IT infrastructure.
 - 3. BACnet MS/TP secondary networks extended from appropriate Network Controllers to associated Advanced Application Controllers.
 - 4. Any use of a proprietary network within a building operation must be identified at the time of bid as an exception to the specification.
- B. Access to system data shall not be restricted by the hardware configuration of the building automation system. The hardware configuration of the BAS network shall be totally transparent to the user when accessing data or developing control programs.
- C. Facility-wide Ethernet Communications Network (Primary Connection)
- 1. Provide a new or extend from an existing Ethernet link for the building-wide peer-to-peer network (Network Controller network). Only one peer-to-peer Network Controller per floor or area shall provide the interface to the BACnet/IP virtual network for remote monitor, remote manual control, remote alarm, and remote programming of sequences of any and all building-wide points (BBMD device).
 - 2. All Ethernet communications shall include software management and control for both access and privilege. This shall manage all rights for access and privilege per each remote location, for remote monitor, remote manual control, remote alarm, and remote programming of sequences of any and all building-wide points.
- D. Building-wide Peer-to-Peer Communications Network:

1. Network Controllers shall directly reside on an Ethernet network such that communications may be executed directly between Network Controllers and workstations on a peer-to-peer basis, without requirement for any device to operate or manage the network. A portion of the network management is built into each of the peer-to-peer members. 'Peer-to-peer' refers to controllers that (when interconnected) will act independently as equals, without a network manager, and will communicate in a token passing protocol with each other to pass data packet information for the purpose of building-wide monitoring and control. A special data packet called the 'token' is constantly and continually 'passed' to every member of the peer-to-peer communications network. Any peer-to-peer device on the network can send a packet of data only when it has the token. Any peer-to-peer device on this network can request data from, or send data to, any other device on the network. With this procedure, token ensures that data collisions do not occur, and assures that all members of the network get equal opportunity for all data on the network.
2. Systems that operate via polled response or other types of protocols that rely on a network manager, file server, or similar device to manage panel-to-panel communications will not be considered.
3. All operator devices either resident on the peer-to-peer network or connected via dial-up modems shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. Access to data shall be based upon logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the peer-to-peer network data.
4. Network design shall include the following provisions:
 - a. Provide high-speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices. System performance shall ensure that an alarm occurring at any DDC Controller is displayed at workstations and/or alarm printers within 5 seconds.
 - b. Support of any combination of DDC Controllers directly connected to the peer-to-peer network. A minimum of 50 devices shall be supported on a single network (including MS/TP).
 - c. Message and alarm buffering to prevent information from being lost.
 - d. Error detection, correction and retransmission shall be included to guarantee data integrity.
 - e. Synchronization of real-time clocks to include automatic daylight savings time updating between all controllers shall be provided. Universal Time Coordinate based upon Greenwich Mean Time must be supported. (All Network Controller devices must have Real Time Clocks with battery and SRAM backup.
5. Acceptable protocols for intercommunications between building-wide peer-to-peer Network Controllers:
 - a. BACnet over Ethernet. If this protocol is not available, then the BAS manufacturer shall identify how building-wide peer-to-peer intercommunication will occur.

E. Local Area (communications) Network (LAN):

1. This communications network shall be limited to Network Controllers and Advanced Application Controllers and shall communicate bi-directionally with the BACnet peer-to-peer network.

2. Advanced Application Controllers shall be arranged on the LAN's in a functional relationship to the corresponding Network Controllers. For example, a VAV Advanced Application Controller serving a VAV terminal box shall be connected on a MS/TP network from the Network Controller that is controlling the corresponding air handling unit.
3. A maximum of 64 Advanced Application Controllers may be configured on any individual LAN from any Network Controller to ensure adequate global data and alarm response times.
4. Acceptable protocols for intercommunications between Advanced Application Controllers and Network Controllers, are as follows:
 - a. BACnet (MS/TP) or BACnet over Ethernet
5. The BAS manufacturer's control components shall not communicate on a proprietary communication network at any level. Any proprietary communication network required for third party control component shall submit to the Engineer and Owner for approval prior to purchase of the component.

2.06 PERFORMANCE SPEED REQUIREMENTS

- A. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
- B. Object Scan: Transmit change of state and change of analog values to control units or workstations within six seconds.
- C. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.

2.07 OPERATOR WORKSTATIONS

- A. Acceptable Manufacturers
 1. Subject to compliance with requirements, provide operator's front end terminals as manufactured by one of the following:
 - a. Dell
 - b. Hewlett Packard
 - c. Acer
 - d. Gateway
 - e. Lenovo
 - f. Sony
 - g. Others, as approved by Engineer
- B. Workstations
 1. Provide a PC for the BAS Server database. Minimum requirements and accessories shall be:
 - a. Processor: Intel "i5" series or AMD equal
 - b. 3GHz processor speed minimum 6M cache
 - c. 4GB Ram, Dual Channel, DDR3 SDRam at 1333MHz minimum
 - d. 16x R/W CD and DVD
 - e. Dual 500GB Hard disk space, 7200RPM to support RAID 1 configuration
 - f. USB Ports
 - g. NIC Card

- h. 101 key enhanced keyboard, Mouse, power strip
 - i. UPS for 15 minute backup
2. Provide an active matrix LCD, flat panel type monitor that supports a minimum display resolution of no less than 1600 × 1200 pixels, Energy Star compliant. The display shall have a minimum of 24-inch visible area in diagonal measurement. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.
 3. Printer 1: Provide a compatible laser printer for printing of dynamic trend graph reports, Excel reports, graphics and any other screen displays.. Provide drivers.
 4. Printer 2: Provide a color printer for printing of alarms, operator transactions and system reports. Printer shall be an Epson 890 or equivalent. Provide drivers.
 5. Locate the BAS Server in a clean, secure, dry and temperature controlled environment.
 6. Provide software licenses for interfacing to the BAS. Load software, configure and setup for viewing the BAS system.
 7. Software: Provide the following application software licenses, preloaded on the Operator Workstation for the Owner: MS Office Professional, PC anywhere or terminal services, Internet Explorer or equal browser, MS Outlook, Acrobat Reader, CAD Viewer. Set up an icon on the desktop to take the Owner directly to the BAS system login page.
- C. Software Requirements
1. Provide and install all required software to allow access to building automation system.
- D. Commissioning Hardware/Software Requirements
1. Provide and install all required software (on laptop PC furnished by the Commissioning Agent) to allow access to building automation system.
 2. Provide all required hardware to Commissioning Agent to allow direct connection to Building Automation System Controllers for the purpose of testing, trouble shooting, and tuning.

2.08 NETWORK CONTROLLERS (JACE's)

- A. All Network Controllers shall be JACE 800 NA-EC-N4-1000 with the following features:
1. ARM A8 Processor 1 GHZ
 2. 1 GB DDR3 SDRAM
 3. (1) micro-SD Card (4GB)
 4. (2) 10/100 MB Ethernet Ports
 5. (2) isolated RS-485 Ports
 6. (1) USB type A
 7. Power Requirements
 - a. 24VAC or 24VDC
 8. Real Time Clock
 9. Battery-Free Design
 10. Supports Optional Modules
 - a. LON

- b. RS-232
- c. Additional RS-485
- d. I/O Modules

2.09 ADVANCED APPLICATION CONTROLLERS (AAC'S)

- A. General: Provide an adequate number of BACnet Advanced Application Controllers to achieve the performance. Each of these panels shall meet the following requirements.
 - 1. DDC (stand-alone) Controllers shall have a 32 bit processor with EEPROM, flash driven operating system (OS). They shall also be multi-tasking, multi-user, real-time digital control processors and permit I/O expansion for control / monitoring of up to 48 I/O. Controller size shall be sufficient to fully meet the requirements of this specification.
 - 2. Advanced Application Controllers shall be fully peer to peer.
 - 3. The operating system of the Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
 - 4. Each Controller shall be capable of monitoring the following types of inputs without the addition of equipment outside of the Controller cabinet:
 - a. Analog inputs
 - 1). 4-20 mA
 - 2). 0-10 VDC
 - 3). Thermistors
 - b. Digital inputs
 - 1). Dry contact Closure
 - 2). Pulse Accumulator
 - 3). Voltage Sensing
 - 5. Each Controller shall be capable of providing the following control outputs without the addition of equipment outside the Controller cabinet:
 - a. Analog outputs
 - 1). 4-20 mA
 - 2). 0-10 VDC
 - 3). 0-135 Ohm (with external Transducer)
 - b. Digital outputs (contact closure)
 - 1). Contact Closure (Motor Starters, up to size 4)
 - 6. Each Controller shall have a minimum of 10 percent spare capacity for future point connection and be supplied with all necessary expansion modules to utilize the spare capacity. The controller shall support up to 48 (minimum) I/O with modular expansion modules. The type of spares shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than two spares of each implemented I/O type. Provide all processors, power supplies, database memory, program sequence memory, and communication controllers complete so that the implementation of any added point (within the above 10% spare) only requires the addition of the point sensor and wiring.

- a. Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.
 - b. Each Controller shall provide at least one RS-232C serial data communication ports (BACnet PTP compatible) for operation of operator I/O devices such as industry standard printers, operator terminals, modems, and laptop portable operator's terminals. Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or terminals. System-wide access must be provided at each mechanical equipment room through the local Controller. Panel mounted terminals are not required.
7. Each Controller shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Controller shall provide both local and remote annunciation of any detected component failures and for repeated failure to establish network communications.
 8. Controllers shall be to control pieces of equipment or systems as indicated or required for operational intent on the drawings. The use of AAC devices for critical or main system equipment will not be permitted.
 9. All points associated with a given mechanical system (i.e., an air handling unit) will be controlled from a single Controller or point expansion panels from the respective controller. No points from a given mechanical system may be distributed among multiple panels - points must be run back to a single Controller dedicated to that mechanical system. Closed-loop control must never depend upon network communications. All inputs, program sequences, and outputs for any single DDC control loop shall reside in the same Controller.
 10. Both firmware and controller database shall be loadable over the network.
- B. Communication
1. Each Advanced Application Controller shall reside on a BACnet network using the MS/TP or Ethernet Data Link/Physical layer protocol.
 2. The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to portable operator's workstation and allow access to the entire network.
 3. Controllers that lose communication or control due to a single sensor failure are not permitted.
- C. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.
1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 40°C [32°F to 100°F].
 2. Controllers used in conditioned space shall be mounted in dust proof enclosures and shall be rated for operation at 0°C to 50°C [32°F to 120°F].
- D. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
1. Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LED's or analog indication of value shall also be provided for each analog output.

- E. Memory: The Advanced Application Controller shall have sufficient memory to support its operating system, database, and programming requirements. The Controller shall utilize non-volatile FLASH memory to maintain its operating system and backup all operator entered changes to setpoints, schedules, and commands.
1. Each Controller shall have sufficient flash memory (EEPROM), a minimum of 2 megabyte, to support its own operating system. In addition, there shall be additional SRAM memory for database handling. Both the EEPROM and SRAM shall permit full implementation and support of all B-BC requirements of this specification, including:
 - a. Control processes
 - b. Energy management applications
 - c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - d. Historical/trend data for points specified
 - e. Maintenance support applications
 - f. Custom processes
 - g. Operator I/O
 - h. Dial-up communications
 - i. Manual override monitoring
- F. Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].
1. In the event of the loss of normal power, there shall be an orderly shutdown of all Controllers to prevent the loss of database or operating system software. Programs residing in memory shall be protected by using EEPROM under capacitor backup. The backup power source shall have sufficient capacity to maintain volatile memory in event of an AC power failure. Where interruptible power source is rechargeable (a rechargeable battery), provide sufficient capacity for a minimum of seventy-two hours backup. Charging circuitry, while the controller is operating under normal line power, shall constantly charge the rechargeable power source. A non-rechargeable power source shall not be permitted. Batteries shall be implemented to allow replacement without soldering.
 - a. Upon restoration of normal power, the Controller shall automatically resume full operation without manual intervention. If manual intervention is required upon loss of normal power, an uninterruptible power supply will be furnished within each control panel to provide a minimum of 2 hours of back-up power. This function will be field demonstrated for each controller.

2.10 APPLICATION SPECIFIC CONTROLLERS (ASC'S)

- A. General: Provide BACnet Application Specific Controllers (ASCs) as required to execute the sequence of operations. ASC's are microprocessor-based DDC controllers which through hardware or firmware design are able to control a wide variety of equipment. They shall be fully user-configurable.
1. Each ASC shall be capable of standalone operation and shall continue to provide control functions without being connected to the network.
 2. Each ASC will contain sufficient I/O capacity to control the target system.
 3. Both firmware and controller database shall be loadable over the network.

4. ASC's shall come with an integrated housing to allow for easy mounting and protection of the circuit board. Only wiring terminals shall be exposed.
- B. Communication
 1. The controller shall reside on a BACnet network using the MS/TP or Ethernet Data Link/ Physical layer protocol.
 2. Each controller shall have a BACnet Data Link/ Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown and allow access to the entire network.
 - C. Environment: The hardware shall be suitable for the anticipated ambient conditions.
 1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40°C to 65°C [40°F to 150°F] and/or suitably installed in a heated or fan cooled enclosure.
 2. Controllers used in conditioned space shall be mounted in dust proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].
 - D. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips.
 - E. Memory: The Application Specific Controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.
 - F. Immunity to power and noise: ASC shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m [3 ft].
 - G. Transformer: Power supply for the ASC must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.
 - H. Input/Output: ASC shall support as a minimum, directly connected, a combination of analog outputs and binary outputs and universal software selectable analog or digital inputs. ASC inputs shall support 0-5 VDC-voltage, 4-20mA-current, thermistor-resistance, and dry contacts. ASC outputs shall support 0-10 VDC-voltage, digital triac rated at 0.5 amps at 24 VAC.

2.11 CONTROLLER RESIDENT SOFTWARE FEATURES

- A. General:
 1. All necessary software to form a complete operating system as described in this specification shall be provided.
 2. The software programs specified in this Section shall be provided as an integral part of Controllers and shall not be dependent upon any higher level computer for execution.
 3. Point naming convention shall be per the Owner's standards. The Controller shall support a 128 character object name length. Controllers that only permit a 32 character length will not be permitted.
- B. Control Software Description:
 1. The Controllers shall have the ability to perform any or all of the following pre-tested control algorithms:
 - a. Two-position control
 - b. Proportional control
 - c. Proportional plus integral control
 - d. Proportional, integral, plus derivative control

2. Control software shall include a provision for limiting the number of times that each piece of equipment may be cycled within any one-hour period.
 3. The system shall provide protection against excessive demand situations during startup periods by automatically introducing time delays between successive start commands to heavy electrical loads. This feature shall be resident in all Binary Output objects. The use of custom programming to prevent an excessive demand on start-up shall not be required.
 4. Upon the resumption of normal power, each Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operations.
- C. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operations. Controllers shall have the ability to perform any or all of the following energy management routines:
1. Time-of-Day Scheduling
 2. 365 Day Calendar-Based Scheduling
 3. Holiday Scheduling
 4. Temporary Schedule Overrides
 5. Start-Stop Time Optimization
 6. Automatic Daylight Savings Time Switch Over
 7. Night Setback Control
 8. Enthalpy Switch Over (Economizer)
 9. Peak Demand Limiting
 10. Temperature-Compensated Duty Cycling
 11. Fan Speed / Control
 12. Heating/Cooling Interlock
- D. Controllers shall be able to execute custom, job-specific processes defined by the user to automatically perform calculations and special control routines.
1. It shall be possible to use any of the following in a custom process:
 - a. Any system measured point data or status
 - b. Any calculated data
 - c. Any results from other processes
 - d. User-defined constants
 - e. Arithmetic functions (+, -, *, /, square root, exponential, etc.)
 - f. Boolean logic operators (and/or, exclusive or, etc.)
 - g. On-delay/off-delay/one-shot timers
 2. Custom processes may be triggered based on any combination of the following:
 - a. Time interval
 - b. Time-of-day
 - c. Date
 - d. Other processes

- e. Time programming
 - f. Events (e.g., point alarms)
3. A single process shall be able to incorporate measured or calculated data from any and all other controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other controllers on the network.
 4. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or phone.
 5. The custom control programming feature shall be compiled and documented via English language descriptors. These descriptors (comment lines) shall be viewable from local operator I/O devices to facilitate troubleshooting.
- E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the Controller's ability to report alarms be affected by either operator activity at a PC workstation, local I/O device, or communications with other panels on the network. Refer to the Owner's alarm standards.
1. The user shall be able to define the specific system reaction for each point.
 2. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
 - a. Each Controller shall be capable of storing all custom alarm text for each alarm. The alarm text shall be unique and user defined; custom text shall be available for all BACnet alarms and shall reside in the Controller, not in an OWS or PC.
 - b. Alarms shall have ability to be acknowledged from the local operator I/O device (once the problem is resolved).
- F. A variety of historical data collection utilities shall be provided for manual or automatic sampling, storing, and displaying system data for points.
1. Controllers shall store point history data for selected analog and digital inputs and outputs:
 - a. Any point, physical or calculated, may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Controller. Two methods of collection shall be allowed either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 second to 7 days shall be provided. Each Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples.
 2. Trend data shall be stored at the Controllers and uploaded to the workstation through the BACnet web server when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command, or automatically when the trend buffers are full. Furthermore, the BACnet web server shall notify the end-user if the hard drive capacity is low or if the database size is excessive. The BACnet web server shall use a standard MSDE or SQL database handler for all trend log management. All trend data shall be available to all BACnet web servers and for use in 3rd party personal computer applications. File format type to be comma delineated.

3. Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops. Provide capability to view or print trend and tuning reports. (Do not initially set up any auto loop tuning algorithms.)
 - a. The Loop object shall display the most recent historical data of its own performance. It shall illustrate the number of setpoint crossings and the maximum and average deviation from setpoint.
 - b. Loop tuning shall be capable of being initiated either locally at the Controller, from a network workstation, or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.
 4. BAS manufacturer shall provide programming time to set up standard trends and create custom reports for each Controller. The BAS Integrator shall program the existing BACnet web server to create historical trend reports for the trends set up by the BAS Contractor.
- G. Controllers shall automatically accumulate and store run-time hours for digital input and output points associated with all pieces of equipment.
1. The totalization routine shall have a sampling resolution of one minute or less.
 2. The user shall have the ability to define a warning limit for run-time totalization. Unique, user-specified messages shall be generated when the limit is reached.
- H. Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and digital pulse input type points.
1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g., kWh, gallons, BTU, tons, etc.).
 2. The totalization routine shall have a sampling resolution of one minute or less.
 3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.
- I. Controllers shall have the ability to count events such as the number of times a fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.
1. The event totalization feature shall be able to store the records associated with a minimum of 9,999.9 events before reset.
 2. The user shall have the ability to define a warning limit. Unique, user-specified messages, up to 200 characters, shall be generated when the limit is reached.

2.12 THIRD PARTY INTERFACES

- A. Manufacturer third party interfaces shall be limited to equipment which the BAS contractor cannot or has not been contracted to control directly via DDC controllers. This equipment shall include but not limited to the following: Process Controls, Generators, ATS, Energy Meters, Lighting Systems, Etc.

2.13 GRAPHICS

1. The following graphic pages shall be constructed in accordance with the Owner's graphics standards.
 - a. Site Home Pages for campuses or stand-alone buildings
 - b. Building Home Pages
 - c. JACE Information (Pop-up) pages for Network Controllers

- d. Floor Plan pages for individual (office) areas/floors served by terminal equipment
- e. System/Equipment Pages for each unique system or piece of equipment, including pop-up windows for setpoints, notes, and attachments
- f. System Overview Pages for terminal equipment systems (VAVs, FCUs, etc.)
- g. Integrated Equipment Pages or pop-up windows (determined by equipment type)
- h. Alarm modifications
- i. Trending pages and pop-up windows
- j. Schedule modifications
- k. Critical equipment dashboard and reports modifications

2.14 PANEL ENCLOSURES

- A. Subject to compliance with requirements, provide Panel Enclosures as manufactured by one of the following:
 - 1. Saginaw Control and Engineering
 - 2. Siemens
 - 3. Hoffman
 - 4. Hubbell
 - 5. Engineer approved equal
- B. Enclosure type shall be appropriate for the mounting location, as described below.
 - 1. Outdoor Use: Stainless Steel NEMA 4 Enclosure
 - 2. Indoor Electrical or Control Room Use: Carbon Steel NEMA 1 Enclosure with baked enamel finish and hinged front access door with foam seals.
 - 3. Indoor Process Area Use (Default Type): Stainless Steel NEMA 4 Enclosure
- C. Panel Requirements:
 - 1. Size panels to accommodate controllers and associated components.
 - 2. Enclosures shall have perforated backplate for device mounting.
 - 3. Enclosures shall have removable hinged door.
 - 4. On the inside door of each enclosure, affix a wiring diagram complete with the following information (at a minimum):
 - a. Control Panel Name
 - b. Control Panel Layout, including device part numbers
 - c. Wiring diagram, with each wiring terminal contained within the enclosure clearly identified by connection or noted as spare.

2.15 PANEL NAMEPLATES

- A. Install an engraved micarta nameplate containing the information outlined below (at a minimum):
 - 1. Control System Cabinet Name
 - 2. Name of Controllers within panel
 - 3. Power source

4. Network source (If applicable)

- B. See drawings for additional requirements

2.16 CONTROL POWER SOURCE AND SUPPLY

- A. BAS Contractor shall provide all power source wiring required for operation of all equipment and devices provided under Division 23 and the BAS Drawings.
- B. Provide power to all controller enclosures from a J-box located in the vicinity of the panel. Connection from the J-box to the enclosure to be by the BAS Contractor. Provide a local disconnect, a 120V convenience outlet, and physical barriers between 120V and 24V wiring.
- C. The Contractor shall assume responsibility for selecting the correct VA rating for each power supply to accommodate individual panel loads.

2.17 VISUAL ALARMS

- A. Provide NEMA 4X strobe warning lights with amber dome color as manufactured by Federal Signal Corporation Model FB24ST, or approved equal, in locations as shown on the drawings. The strobe lights shall be supervised and shall be initiated upon ventilation system failure. The Contractor shall select the appropriate voltage and mounting accessories.

2.18 SURGE PROTECTION

- A. Contractor shall furnish and install any power supply surge protection, filters, etc. as necessary for proper operation and protection of all NCs.
- B. Surge transient protection shall be incorporated in design of system to protect electrical components in all Network Controllers and Advanced Application Controllers. Provide an external protection device listed under UL 1449 with minimum clamping voltage of 130 VRMS and surge current capability of 22,500 Amps for all custom fabricated control panels and all main system components (i.e., AHUs, Chillers, Boilers, etc.).
- C. All equipment shall be capable of handling voltage variations 10 % above or below measured nominal value, with no effect on hardware, software, communications, and data storage.

2.19 LABELING

- A. Provide labels for panel enclosures and all field devices including sensors, transducers, thermostats, and relays.
- B. Labels shall be black laminated plastic and epoxy glue or screw fasteners. Labels shall be located adjacent to device and permanently affixed to device mounting surface. Labels for sensors in pipes may be secured using chain around the sensor well. Labels shall be 1/16" thick laminated plastic or 0.020" thick aluminum; black face, 3/16" high white or natural aluminum letters.
- C. Identify all control wiring and air piping at each end with a wire tags or labels. Wiring to be labeled as to what the wire serves not just to identify ends of wire. In addition, use standardized color scheme for control wiring to designate type of control each wire serves.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examine areas and conditions under which control systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
- B. These specifications call out certain duties of the Contractor and any subcontractor(s). They are not intended as a material list of all items required by the Contract.

3.02 INSTALLATION

- A. Utilize licensed electricians for all new and retrofitted electrical distribution systems and comply with Division 26 electrical specifications.

- B. All control wiring incidental to the Temperature Control System shall be by the Temperature Control Contractor except as follows:
 - 1. Line voltage thermostats shall be turned over to the Electrical Contractor for installation and wiring.
 - 2. Wiring shown on the Electrical Contract Drawings shall be wired by the Electrical Contractor.

- C. Provide related items and work indicated on the BAS Drawings and items and work called for in this Division of the Specifications. This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start up, configuration, programming, and commissioning coordination on each control product and system to provide fully operable systems in accordance with the specified functional performance.
 - 1. All control elements shall be placed in locations affording easy access for service. All devices remote from control panels shall be identified as specified for control items in control panels.

- D. All temperature control panels shall be completely prewired by the BAS Contractor to terminal strips within the control cabinet. All internal interlock wiring within the control panel shall be complete to the terminal strips.

- E. All 120V and low voltage electrical control wiring exposed throughout the building and within walls shall be run in conduit in accordance with the Electrical requirements as specified in Division 26, the Owner's standards, the National Electric Code, and all applicable local codes. All wiring shall comply with specification Section 23 09 40.

- F. All conduit and conduit installation, including conduit utilized for plastic pneumatic tubing, shall be in accordance with the requirements of Division 26, Electrical Specification.

- G. Installation shall be in accordance with manufacturer's published recommendations and shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

- H. Adjusting
 - 1. Calibrating and Adjusting:
 - a. Calibrate instruments.
 - b. Make three-point calibration test for both linearity and accuracy for each analog instrument.
 - c. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
 - d. Control System Inputs and Outputs:
 - 1). Check analog inputs at 0, 50, and 100 percent span.
 - 2). Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
 - 3). Check digital inputs using jumper wire.
 - 4). Check digital outputs using ohmmeter to test for contact making or breaking.
 - 5). Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
 - e. Flow:

- 1). Set differential pressure flow transmitters for 0 and 100 percent values with 3 point calibration accomplished at 50, 90, and 100 percent span.
 - 2). Manually operate flow switches to verify that they make or break contact.
- f. Pressure:
- 1). Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - 2). Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
- g. Temperature:
- 1). Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - 2). Calibrate temperature switches to make or break contacts.
- h. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
- i. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
- j. Provide diagnostic and test instruments for calibration and adjustment of system.
- k. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures for review and approval before initiating startup procedures.
2. Adjust initial temperature and humidity set points.
 3. Occupancy Adjustments: Provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.
- I. The BAS Drawings show the general arrangement of the respective systems. Follow these Drawings as closely as actual building construction and the work of other trades will permit. Provide devices, power, fittings, sensors, controllers, wiring, and accessories, which may be required but are not shown on the Drawings or specified herein. The Contractor shall be responsible for achieving the sequence of operations and intent of the system design.
- J. All installation shall be in accordance with manufacturer's published recommendations.
- K. Limit LAN cable lengths to no longer than 80% of the longest dimension published by the manufacturer of the cable between the most remote network nodes.
- L. Comply with all rules, guidelines and procedures defined by the Owner's IT authority.

3.03 IDENTIFICATION

- A. Control Device
1. For each control device (i.e. sensor, switch, actuator, terminal strip, relay, etc.) provide and install an adhesive laminated label which clearly and uniquely identifies device.
 2. Control device labeling shall be coordinated with as-built wiring diagrams, such that any device can be referenced to the wiring diagrams.
 3. Include the following (as a minimum)
 - a. Device Identifier

- b. Controlling/monitoring controller
 - c. Power source
- B. Wiring
 - 1. Label all Controller I/O wiring at each end (controller and device) with an identifier which clearly indicates controller and terminating point number.
- C. Panel Nameplates
 - 1. Permanently adhere nameplates on all control system cabinets.
- D. Transformers
 - 1. For each control transformer, clearly note the following
 - a. Power Source (including panel name, location, and circuit number)
 - b. Device(s) served.

3.04 NETWORK MANAGEMENT FUNCTIONAL REQUIREMENTS

- A. Contractor shall thoroughly and completely configure BAS system control devices, software, supplemental software, application programming, network communications, Servers, operator workstations, printer, and network communications to permit the functional requirements of the BAS herein specified. The setup shall include as a minimum the following network management procedures:
 - 1. Automatic backup of the BAS System database to appropriate media.
 - 2. Program, load and debug all software installations, including integration of third party applications (e.g. analytics and energy management).
 - 3. Network user auditing.

3.05 SITE CLEAN UP

- A. At conclusion of each day's work, and at the request of the Owner, clean up and remove from the site all rubbish, debris, and trash accumulated during the day as a result of work of the Contractor.
- B. Marks on walls or ceiling tiles caused by the Contractor shall be cleaned by the Contractor. Ceiling tiles, drywall, carpet, paint, and all architectural finishes damaged by the Contractor shall be replaced by the Contractor.

3.06 BAS CONTRACTOR'S CHECK OUT, START-UP TESTING, ADJUSTING, CALIBRATION

- A. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. The installer shall complete all testing, calibrating, adjusting, and final field tests. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Upon completion of the work, notify the Owner and Engineer that the system is ready for final tests and inspection.
- B. At the time of final inspection, this Contractor shall be represented by a person with the proper authority who shall demonstrate, as directed by the Engineer, that his work fully complies with the purpose and intent of the Specifications and Drawings. Labor, services, instruments, and tools necessary for demonstrations and tests shall be provided by the Contractor.
- C. The Contractor shall test and adjust each instrument specialty and equipment furnished by him, prior to final acceptance. The Contractor shall demonstrate, for approval by the Engineer, a properly functioning, integrated system with subsystems operating as coordinated.
- D. The Contractor shall furnish labor to provide adjustments and incidentals necessary to obtain the desired and intended results.

- E. The Contractor shall turn over a printed copy and electronic copy of the completed and debugged operating software to the Owner at the conclusion of the warranty period.
- F. Work and/or systems installed under this Division shall be fully functioning prior to Demonstration and Acceptance Phase.
- G. Contractor shall conduct the CCO which addresses the start-up, testing, adjustments, and calibrations of all work and/or systems under this Contract.
- H. All CCO testing procedures shall be documented in the CCO report to be provided by the contractor to the Owner.

3.07 OWNER TRAINING

- A. Provide Owner Training per requirements of Section 23 02 10.

3.08 SUMMARY OF BAS ACCEPTANCE PROCEDURE

- A. Submit product data, Shop Drawings, logic documentation, and sample graphics to the Engineer of Record and receive approval.
- B. Obtain Owner's acceptance of each phase of installation when installation consists of a renovation in an occupied space.
- C. Submit as-built record documents.
- D. Provide the Owner an agenda and schedule of CCO testing activities for approval and coordination.
- E. Provide written notice that the system is ready for Owner acceptance testing. Schedule BAS Demonstrations with Owner.
- F. Demonstrate BAS systems to Owner and Engineer. Perform functional performance testing including sequence of operation, point to point verification to graphical interface, historical data logging, and alarms.
- G. Owner to provide detailed punch list to contractor.
- H. Contractor to repair issues on Owner punch list in seven (7) calendar days.
- I. Contractor provides all passphrases, usernames, passwords, software, GUI, databases, licenses, and application programming tool(s) to Owner.
- J. Contractor Trains Owner on all aspects of the BAS including architecture, devices, software, final sequences, and modes of operation.
- K. Owner issues letter to contractor declaring that system is substantially complete. Date of this letter starts the warranty period.
- L. Revise and re-submit as-built record Drawings and O&M Manuals.
- M. Final Acceptance. Owner issues letter to Contractor accepting system.

END OF SECTION 23 00 00

SECTION 23 92 10
WIRE AND CABLE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish material, tools, labor, and supervision necessary to install wire and cable.

1.03 STANDARDS AND CODES

- A. Methods of installation shall comply with the provisions of applicable sections of NEC, Article 300.
- B. Materials shall be in accordance with NEC, Article 310 and shall be UL listed for application intended.

1.04 DESCRIPTION

- A. This section describes the basic materials and methods of installation for general wiring systems of 600 volts and less. Wiring for a higher voltage rating, if required, shall be as specified in other sections or as called for on the drawings.
- B. Minimum size conductors shall be No. 12 AWG for power and lighting and No. 14 AWG for signal and control.
- C. Refer to Spec Section 260053 for specific instructions with respect to sizing and installation of feeder and branch circuit conductors.

1.05 QUALIFICATIONS

- A. The material used for the wiring systems shall be the products of a manufacturer regularly engaged in the manufacturing of the specified material. Where a manufacturer is named for a particular material, the material of other manufacturers will be acceptable provided the material meets requirements of the Specifications.

PART 2 PRODUCTS

2.01 WIRE AND CABLE

- A. Wire and cable for power, lighting, control and signal circuits shall have copper conductors of not less than 98% conductivity and shall be insulated to 600V. Conductors shall be stranded except where specifically noted otherwise.
- B. Wire and cable type for the various applications shall be as follows:
 - 1. Type THWN or XHHW (75°C): Use for branch circuits, panel and equipment feeders in wet and dry locations.
 - 2. Type THHN or XHHW (90°C): Use for branch circuits, panel and equipment feeders in dry locations only. Use where lighting branch circuit conductors are routed through fluorescent fixture channels.
 - 3. Type "VFD Rated": Feeders, size #8 AWG and larger, from variable frequency drives shall be multi-conductor shielded cables with the following performance requirements.
 - a. Phase conductors shall be tinned copper, extra flexible 34 AWG Class M stranding (size 10 AWG and smaller) or 30 AWG Class K stranding (size 8 AWG and larger), with XLPE insulation.
 - b. Ground conductors shall be tinned copper, 100% rated, and symmetrically spaced (three ground cables total).

- c. Shielding shall consist of 100% aluminum foil shield with 85% tinned copper braided shield (size 2 AWG and smaller) or two (2) copper tape shields with 100% coverage (size 1 AWG and larger).
- d. Overall cable jacket shall be type TPE, sunlight and oil resistant, and have a tray cable exposed rating, Type TC-ER.
- 4. Type UF: Use where permitted by other Sections or by the drawings for underground direct burial branch circuits.
- 5. Type AF or SF-2 silicone rubber with heat-resistant glass braid (rated minimum 150°C) shall be used for branch circuit conductors connecting to fixture conductors within the fixture housing or to a connection box attached to the fixture and subject to temperatures equal to the temperatures within the fixture housing.

2.02 CONDUCTOR COLOR CODING AND IDENTIFICATION

- A. Wiring systems shall be color coded. Conductor insulation shall be factory colored in sizes up through No. 8 AWG. Conductors No. 6 AWG and larger shall have black insulation and shall be phase color coded with one half inch band of colored tape at all junctions and terminations. Colors shall be assigned to each conductor as described below and carried throughout all main and branch circuit distribution.

	<u>208/120 Volt</u>	<u>480/277 Volt</u>
Phase 'A'	Black	Brown
Phase 'B'	Red	Orange
Phase 'C'	Blue	Yellow
Neutral	White	Gray
Equipment Ground	Green	Green
Isolated Equipment Grounding	Green w/ Yellow Stripe	

- B. Contractor shall take extraordinary care to ensure that phase and bus orientation in each and every panel is identical.
- C. Control wiring shall be color coded such that red is used exclusively for all 120 volt conductors and white for all neutral conductors. All control wiring to be identified at both ends with permanent wire markers.

2.03 CONNECTORS

- A. Splices and junctions for conductors #8 AWG and smaller shall be 600V rated with "live spring" and insulated rigid nylon wing style body, 3M "Performance Plus", Ideal "Buchanan B-Cap", or equal.
- B. In-line connectors for 600V copper conductors #6 AWG thru #3 AWG shall be ILSCO type "CT" circumferential compression sleeves or equal by 3M, Burndy, or Thomas & Betts.
- C. In-line connectors for 600V copper conductors #2 AWG and larger shall be extra long barrel dual-crimp ILSCO type "CTL" compression sleeves or equal by 3M, Burndy, or Thomas & Betts.
- D. Insulate in-line connectors with cold shrink silicone insulators 3M "8440" series.
- E. Taps for copper conductor 600V or less, sizes No. #6 AWG and larger shall be ILSCO "AH" series or equal by 3M, Burndy, or Thomas & Betts.
- F. Insulate taps to thickness of conductor insulation with half-lapped layers of 3M "Scotch" brand No. 33 vinyl electrical tape. Connectors having irregular surfaces; fill voids and smooth contours with 3M "Scotchfil" electrical putty prior to taping.
- G. Where mechanical style connections are permitted, cable terminations to bus bars and switch pads shall be ILSCO "TA" two-hole mechanical or equal by 3M, Burndy, or Thomas & Betts.

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- H. Where compression style connections are required, cable terminations to bus bars and switch pads shall be ILSCO "CLWD" two-hole long-barrel dual-crimp compression type with sight hole or equal by 3M, Burndy, or Thomas & Betts.
 - 1. Lugs installed in wet locations on poles or outdoors where exposed shall be furnished without sight hole, ILSCO "CLND" or equal by 3M, Burndy, or Thomas & Betts.
 - I. Mechanical and compression termination bolt/stud size and mounting hole spacing shall match factory bus hole size. Stacking lugs and spacers shall be provided as required for parallel cable runs.
 - J. Cable terminations at motors shall be bolted and removable with 1-hole copper compression lugs on the motor pigtail and feeder conductors, and motor terminal insulation kit 3M "5300" series, or equal. Motor terminal insulation kit shall include lug cover, mastic strip Scotch No. 2230, silicone grease, and Scotch No. 33 tape.

PART 3 EXECUTION

3.01 PREPARATION

- A. For new construction, wiring shall not be installed in the conduit system until the building is enclosed and masonry work is completed.
- B. Conduit shall be swabbed free of moisture and debris prior to pulling in the conductors.

3.02 CONDUCTOR INSTALLATION

- A. Feeder conductors shall be routed continuous from origin to destination, without splicing, unless specifically noted otherwise on the drawings.
- B. Power feeder conductors shall be pulled with the use of an approved pulling compound or powder, and per the requirements of Section 260125.
- C. Conductor splices shall be made only in readily accessible junction boxes.
- D. Cable supports and boxes shall be installed in all vertical feeders required by Article 300.19 of the National Electrical Code. Cables shall be supported at the top of the vertical raceway plus an additional support for each interval of spacing as specified in table 300.19 (A) of the NEC. For cables without a metallic sheath, the cable support shall be of the split wedge type which clamps each individual conductor firmly and tightens due to weight of cables.
- E. "VFD Rated" multi-conductor shielded cables shall be terminated according to the manufacturers recommendations. Braided shields shall be routed unbroken where service disconnects are located between the VFD and motor. Phase and ground conductors shall be pulled through braided shields at each end and terminated together with the ground conductors.

3.03 CONDUCTOR TERMINATIONS

- A. Terminations materials shall be as required by the equipment manufacturer's installation guidelines.
- B. Bolt diameter shall be properly sized for the terminations, in the absence of manufacturer's installation requirements, the largest diameter shall be used.
- C. Bolts shall be tightened to the torque values specific to the material, threads per inch, and nominal diameter. Bolted connections shall not be lubricated.
- D. Unless stipulated otherwise, the minimum grade bolt material shall be SAE J429 Grade 5 medium carbon steel.
- E. Belleville spring type washers shall be utilized for termination of conductors 350MCM and larger. Split ring lock washers shall be utilized on smaller conductor terminations.
- F. Connections shall be initialed or otherwise labeled after final torquing.

3.04 CATEGORY 5e/6 TESTING

- A. Each channel shall be tested as a whole. The channel shall include each cable pair, jack, and patch panel.

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- B. Each channel shall be tested for length, DC continuity, NEXT, PSNEXT, attenuation, return loss, ELFEXT, and PSELFEXT using tester for Category 5e/6 channel compliance.
 - C. Each channel shall be field tested for 100 MB transmission at 250 MHz.
 - D. Complete test and inspection records shall be conducted as described in EIA/TIA 568, 606, 607, and TSB/EIA-40, 67 and 75 telecommunication standards.

END OF SECTION 23 92 10

SECTION 23 92 11 CONDUIT SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish materials, tools, labor, and supervision necessary to fabricate and install complete conduit systems.
- B. Conduit systems shall be provided for all wiring, except where the Drawings or other specification sections indicate that wiring is permitted to be installed without conduit.

1.03 STANDARDS AND CODES

- A. Methods of fabrication and installation shall comply with the provisions of applicable Section NEC, Article 300.
- B. Materials shall be UL and NEC approved for the application intended.

1.04 DESCRIPTION

- A. This Section describes the basic materials and methods of installation for circular cross section conduit systems. Other types of conduit or raceways when required shall be as specified in other Sections, or as called for on the Drawings.

1.05 QUALIFICATIONS

- A. The materials used in the fabrication of the conduit system shall be products of a manufacturer regularly engaged in the manufacturing of the specified material. Where a manufacturer is named for a particular material, the material of other manufacturers shall be acceptable provided the material meets requirements of the specification.

PART 2 PRODUCTS

2.01 CONDUIT

- A. Coated Rigid Conduit: Full weight, threaded, rigid steel, 40 mil PVC coated on outside, 2 mil urethane coated on inside conduit. Approved sources for this raceway are Robroy "Plastibond-Red" (Westwood Electrical Sales, 440-835-9960), Ocal, Inc "Ocal-Blue" (Greisser Sales, 216-771-6120), or Calpipe Industries "Calbond" (Fields Electrical Sales, 513-228-1010). All associated raceway fittings, sweeps, etc., shall be coated. Field cut raceways shall be touched up with matching finish. Use for all conduit, regardless of size, where installed in earth fill, or where specifically required by the drawings.
- B. Rigid Conduit - Aluminum: Full weight, threaded, rigid aluminum conduit may be used for all conduit, regardless of size, where installed exposed outdoors on roofs or in damp/wet locations or where specifically required by the drawings. Expansion fittings and supports shall be utilized to absorb and prevent deflections due to thermal expansion.
- C. PVC Conduit: Schedule 40 heavy wall rigid, rated for 90°C cable, composed of polyvinyl chloride and shall conform to NEMA Standards. Conduit, fittings, and pipe-joining materials shall be produced by the same manufacturer. At Contractor's option and where permitted by NEC and local jurisdiction, PVC conduit may be used where buried outside building, or encased in concrete, or in/below floor slabs. Electrical Contractor shall be responsible for upsizing raceway if necessary as required by NEC.

2.02 CONDUIT FITTINGS

- A. Rigid Conduit Fittings: Threaded, galvanized malleable iron or heavy steel, water and concrete tight.
- B. Metallic Tubing Fittings: Set screw type galvanized steel, concrete tight. Die cast type indentor type fittings will not be allowed.

- C. Flexible Metal Conduit Fittings: Squeeze or screw type galvanized malleable iron or steel with nylon insulated throats, or steel with set screws.
- D. Liquid-tight Flexible Metal Conduit: Galvanized malleable iron or steel, with watertight gaskets, "O" ring and retainer, and nylon insulated throats.
- E. Condulet Fittings: Exposed conduit fittings shall be condulet type for sharp turns, tees, etc. Condulet covers shall be gasketed where exposed to moisture.
- F. Threaded conduit terminations for weatherproof applications shall be made by use of Myers Hubs.

2.03 OUTLET BOXES

- A. Material, size and installation for outlet boxes shall comply with NEC Article 314.
- B. Boxes shall be Raco, Steel City, Appleton or equivalent, catalog numbers listed below are based on Raco, unless otherwise indicated. In general the type of boxes shall be as follows:
 1. In stud walls: For single outlet use 4" square by 2-1/8" deep box No. 232 or 233. For ganged outlets use 4-1/2" high by 1-13/16" deep multiple gang boxes No. 951 through No. 958. Boxes to be provided with raised adapters of depth as required for thickness of wall materials.
 2. In masonry and poured concrete walls: For single outlets requiring two conduit connections in top and/or bottom of box use 4" square by 2-1/8" deep box No. 232 or 233 with raised square cut adapter. For ganged outlets use 3-3/4" high by 2-1/2" deep multiple gang masonry boxes No. 691 through No. 694 and No. 960 through No. 964.
 3. Surface mounted wall outlets: For single outlet use 2-1/8" deep handy box No. 674, for two outlets use 4" square by 2-1/8" deep box No. 232 or 233. For more than two ganged outlets use 3-3/4" by 2-1/2" deep multiple gang masonry boxes No. 692 through No. 694 and No. 960 through No. 964. Boxes to be provided with 1/2" raised cover as required for device.
 4. In suspended ceilings: Use 3-1/2" deep octagon box No. 280 or No. 281 with fixture studs and steel mounting bars.
 5. In poured concrete ceiling slabs: Use octagon concrete rings with back plates.
 6. Where outlet boxes are free standing on conduit stubs in kitchens, laundries, shops and other areas indicated, use Crouse-Hinds Type FS or FD malleable iron cadmium finish boxes with appropriate gasketed cover plate to suit device.
 7. Outlets installed outdoors or in wet locations: Use Crouse-Hinds Type FS or FD box with NEMA 3R coverplates listed for "raintight while in use" for receptacles. Covers for switches shall be Crouse Hinds No. DS185. Diecast "bell" type boxes are not acceptable.
 8. Floor outlets in above grade concrete slabs: Use concrete tight stamped steel galvanized box with fully adjustable top, Hubbell No. B-2527 for greater than 3" fill, No. B-2529 for 2" to 3" fill. Floor outlets in concrete slabs on grade: Use watertight cast iron box with fully adjustable top, Hubbell No. B-2536 for greater than 3" fill, No. B-2537 for 2" to 3" fill. Furnish for each outlet a No. S-2525 cover. Service fittings shall be as described on the Drawings. Furnish for each outlet in carpeted floor a No. S-3082 carpet flange.

2.04 PULL AND JUNCTION BOXES

- A. Construction, size and installation of pull and junction boxes shall comply with NEC, Article 314.
- B. Pull and junction boxes shall be fabricated of heavy gauge galvanized steel with screw covers, brass screws and hardware with enamel finish.

- C. Pull and junction boxes for installation in poured concrete floors shall be flush type, cast iron, with watertight gasketed covers. Boxes for installation in floors with tile or carpet floor covering shall have recessed covers to accommodate the floor covering.
- D. Pull and junction boxes for above grade outdoor installations shall be rain-tight.
- E. Grade level junction boxes shall be manufactured by Synertech or CDR Systems Corporation with open flared bottom and cover. Logo on cover to read "ELECTRIC", etc. Enclosures and covers shall be concrete gray color and rated for no less than 5,000 pounds over a 10" x 10" area and be designed and tested to temperatures of -50 degrees F. Material compressive strength should be no less than 11,000 psi. Covers shall be secured with two pentahead stainless steel bolts. Bolts shall be retained in lid when unscrewed. Bolts shall be secured to replaceable threaded inserts with openings at base to allow debris to fall through and thereby avoiding clogged threaded inserts.

2.05 AUXILIARY GUTTERS

- A. Construction, sizes and installation of auxiliary gutters shall comply with NEC, Article 366.

2.06 HANGERS AND SUPPORTS

- A. Provide conduit hanger and support devices of approved type for required methods of support to include: structural steel members, suspension rods, conduit clamps, concrete inserts, expansion shields, beam clamps and welding pins. All devices shall have galvanized finish or other approved corrosion resistive finish. In general, hangers and supports shall be as follows:
 1. Where a multiple run of conduit is routed on surface of structure, use conduit clamps mounted on Unistrut or equal channel so as to maintain clearance between conduit and structure.
 2. Where single run of conduit is suspended from overhead; use split ring conduit clamp suspended by steel drop rod.
 3. Where multiple parallel runs of conduit are suspended from overhead; use split ring conduit clamps uniformly spaced and supported on trapeze hangers fabricated of Unistrut Channels, suspended by not less than 1/2" continuously threaded steel drop rods.
 4. Where conduit is buried in concrete floor slabs; anchor conduit to structural floor with conduit clamps, at 10'-0" (maximum) intervals.
 5. Any form of strap iron or wire hangers will not be accepted.
 6. Maximum hanger and support spacing shall be in accordance with NEC Sections 342.30 (IMC), 344.30 (GRC), and 358.30 (EMT). Regardless of listed spacing provide additional hangers or supports at not more than 2'-0" from each change of direction and at each side of any box or fitting.
- B. Hangers and supports shall be anchored to structure as follows:
 1. Hangers and supports anchored to poured concrete: Use malleable iron or steel concrete inserts attached to concrete forms.
 2. Hangers or supports anchored to precast concrete: Use self-drilling expansion shields. Expansion shields may also be used where concrete inserts have been missed or additional support is required in poured concrete.
 3. Hangers or supports anchored to structural steel: Use beam clamps and/or steel channels as required by structural system.
 4. Hangers or supports anchored to metal deck: Use spring clips or approved welding pins. Maximum permissible load on each hanger shall not exceed 50 pounds.
 5. The use of explosive force hammer actuated, booster assist or similar anchoring device will not be permitted without prior approval of the Architect.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

- A. In general, horizontal runs of conduit shall be installed in ceiling plenum. Conduit for convenience outlets, wall mounted fixtures and other wall outlets shall be routed overhead and concealed in wall to the outlet. Conduit shall not be installed in concrete floor slabs except where conditions will not permit the conduit to be routed overhead.
- B. Generally, conduit shall be concealed, except in crawl spaces, tunnels, shafts, mechanical equipment rooms, and at connections to surface panels and free-standing equipment, and as otherwise noted on Drawings. No surface raceways shall be used on the floor.
- C. Exposed conduit shall be routed in lines parallel to building construction lines. Exposed conduit locations shall be approved by the Architect prior to installation.
- D. No conduit shall be installed less than 6" from piping installed by other trades. Conduits shall be located to avoid ductwork, piping and other obstructions.
- E. Certain conduits are permitted to be embedded in structural concrete work. Contractor shall cooperate with other Contractors of their respective trades to effect the following:
 - 1. Reinforcing steel shall be securely anchored in place before installing conduit.
 - 2. No steel reinforcing shall be displaced from plan dimensions without approval of Architect.
 - 3. Conduit shall not be placed over top of reinforcing or under bottom of reinforcing, where crossing beams.
 - 4. Conduit and fittings shall not displace concrete in columns in excess of 4% of total cross-section area of column without approval of Architect.
 - 5. Conduit shall not be placed closer than 3 diameters on center.
 - 6. Maximum size of embedded conduit or pipe shall not exceed 1/3 thickness of structural slab; 2/3 thickness of topping slab.
- F. Minimum size conduit shall be 1/2" trade size. Where specific size is not called for on Drawings or in the specification, Contractor shall select size required from Chapter 9 of NEC. Where specific sizes required by Drawings or Specifications are larger than Code requires, the larger size shall be installed.
- G. Install the conduit system mechanically and electrically continuous from outlet to outlet and to cabinets, junction or pull boxes. Conduit shall enter and be secured to cabinets and boxes in such a manner that all parts of the system will have electrical continuity. Feeder raceways shall terminate in cabinets and pull boxes with double locknuts and insulating bushings.
- H. Metal conduit buried in earth fill shall be protected with an approved corrosion resistant material.
- I. Conduits shall be capped during construction to prevent the entrance of foreign materials and moisture.
- J. Where conduits cross building expansion joints, O-Z Gedney Company type "DX" conduit expansion fittings complete with bonding jumpers shall be used.
- K. Contractor shall cut and patch existing construction for conduit installation as required.

3.02 OUTLET BOX INSTALLATION

- A. Outlet boxes shall be installed for fixtures, switches, receptacles and other devices.
- B. Approximate location of outlets are shown on the plans, but each outlet location shall be verified by the Contractor before installing the outlet box.
- C. Openings for electrical boxes in fire-rated walls that do not exceed 16 square inches in area are permitted in fire-rated construction provided that the aggregate area of such openings does not exceed 100 square inches for any 100 square feet of wall area.

- D. Where service utility boxes greater than 16 square inches exist in fire-rated wall construction, if the opening is not otherwise detailed to maintain the fire-rated integrity of the wall, provide firestopping wrap to the back side of each utility box.
- E. Outlet boxes on opposite sides of fire-rated walls shall be separated by a horizontal distance of not less than 24 inches.
- F. Outlet boxes installed flush in a common wall shall not be back-to-back or through-wall type, unless construction requires same. Where it is necessary to install boxes back-to-back, install sound absorption material between boxes and seal the conduit nipple between boxes with duct seal.
- G. Boxes located on opposite sides of a common wall that are connected by 12" conduit length or less, shall have the conduit openings plugged with duct seal at both ends.
- H. Outlet boxes shall be installed plumb and square with wall face and with front of box or cover located within 1/8" of face of finish wall. Boxes in masonry shall be set with bottom of the box tight to the masonry unit.

3.03 PULL AND JUNCTION BOX AND GUTTER INSTALLATION

- A. Install pull boxes, junction boxes and auxiliary wiring gutters where indicated on Drawings and where required to facilitate installation of the wiring.
- B. For concealed conduit, install boxes flush with ceiling or wall, with covers accessible and easily removable. Where flush boxes are installed in finished ceilings or walls, provide cover which shall exceed the box face dimensions by a sufficient amount to allow no gap between box and finished material.
- C. Boxes shall not be exposed in finished, occupied rooms, without prior approval of Architect.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Hangers and supports shall be installed for all conduit and boxes.
- B. Conduit and boxes shall not be attached to or supported from mechanical pipes, plumbing pipes or sheet metal ducts.
- C. Conduits routed in lay-in grid ceiling plenum shall not be supported from the ceiling hanger iron or ceiling tees.

END OF SECTION 23 92 11

SECTION 23 92 12 PULLING CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide material, equipment, labor, and supervision as required for the complete installation of wire and cable in raceways.

1.03 CODES AND STANDARDS

- A. Methods of installation shall comply with the provisions of applicable sections of NEC Article 300.

PART 2 PRODUCTS

2.01 Products shall be used as described under Part 3.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Suitable installation equipment shall be provided to prevent conductor and raceway damage during the installation of feeders. Ropes used for pulling of feeders in metallic raceways shall be made of polyethylene or other suitable non-metallic material. Metallic ropes shall not be used.
- B. Cable installation in PVC or similar non-metallic raceways or innerducts require the use of woven pull tapes. Tapes shall be Fibertek or equal.
- C. A #14 galvanized steel fish wire or a plastic line having a tensile strength of not less than 200 pounds shall be installed in each conduit, except underground conduits, in which installation of conductors is not included in this section of the Specification. A #10 AWG bare, hard drawn copper shall be installed in each underground conduit or duct, in which installation of conductors is not included in this section of the Specification. Woven tape with embedded copper conductor may be used in lieu of #10 bare. Fibertek "Tracertape" or approved equal.
- D. Fish wires and lines shall be free from splices and shall have ample exposed length at each end.
- E. Wire pulling lubricants, if used, shall conform to UL requirements applicable to the several insulation and raceway materials.
- F. Cables shall not be bent, either permanently or temporarily during installation, to radii less than 10 times the outer diameters, except where shorter radii are approved for conditions making the specified radius impractical.
- G. Pulling lines shall be attached to conductor cables by means of either woven basket grips or pulling eyes attached directly to the conductors. Rope hitches shall not be used. All cables to be installed in a single conduit shall be pulled in together. Where polyethylene insulation is used and a pulling lubricant is required, the lubricant shall be certified by the manufacturer to be non-injurious to polyethylene insulation.
- H. Refer to Section 260120 for cable supports and boxes required for installation of all vertical feeders.

END OF SECTION 23 92 12

SECTION 23 93 10
CONTROL SYSTEM COMPONENTS IDENTIFICATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies mechanical system equipment and piping identification and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

PART 2 PRODUCTS

2.01 TEMPERATURE SENSORS

- A. General
 - 1. Each temperature sensor shall match the requirements of the associated temperature controller and shall be based upon 10-K thermistors.
 - 2. Each sensor shall be designed for the appropriate application (i.e., duct, immersion, etc.) and be provided with all necessary installation accessories.
 - 3. Ranges shall be selected to the middle of the control range.
 - 4. Space sensors in office spaces shall have LCD display, set point adjustment, and service port.
 - 5. Install thermostats and sensors at 4'-6" AFF to bottom unless otherwise noted on Architectural Drawings. Coordinate installation with the work of other trades before any rough-ins are made. Thermostats may be installed up to 500 feet from controller.
 - 6. Provide temperature sensors as required to meet the sequence of operation.
- B. Wall Mounted
 - 1. Accuracy: +/- 0.5°F at calibration point.
 - 2. Provide with the following options when specified:
 - a. Setpoint warmer/cooler
 - b. Individual heating/cooling setpoint
 - c. Momentary override request for activation of after-hours operation
 - d. Analog thermometer
 - e. Integral LCD display with the following capabilities when specified:
 - 1). Display room air temperature
 - 2). Display and adjust room comfort setpoint
 - 3). Display and adjust fan operation status
 - 4). Setpoint override request via setpoint adjust dial or buttons
 - 5). Timed override request via occupancy override with status indication for activation of after-hours setpoint operation
 - 6). Occupancy sensor status

- 7). Toggle between °F and °C.
 - 8). Toggle between temperature and humidity
 - f. Security Sensor: stainless steel cover plate with insulated back and security screws
- C. Duct Mounted - Averaging
- 1. Accuracy: +/- 0.5°F at calibration point.
 - 2. Use where ducts are larger than 10 ft² or are subject to temperature stratification.
 - 3. Provide with all required mounting hardware.
- D. Duct Mounted – Point
- 1. Accuracy: +/- 0.5°F at calibration point.
 - 2. Use where ducts are smaller than 9 ft² or are not subject to temperature stratification.
 - 3. Provide with mounting plate.
- E. Well Mounted
- 1. Accuracy: +/- 0.5°F at calibration point.
 - 2. Brass or stainless-steel socket with minimum insertion length of 2.5 inches for pipes up to 4" diameter and 6 inches for pipes up to 10" diameter.
- F. Exterior
- 1. Accuracy: +/- 0.5°F at calibration point.
 - 2. Weather resistant.
 - 3. Wind and sun shield.
 - 4. Enclosure suitable for outdoor temperatures of -20 to 110°F.
- G. High Limit Thermostat
- 1. Averaging type, with adjustable high limit.
 - 2. Manual reset type.
 - 3. Form C contacts.
 - 4. Sensing element of 20 ft minimum length.
 - 5. One sensor to cover 24 sq. ft. of protected area.
- H. Low Limit Thermostat
- 1. Averaging type, with adjustable low limit.
 - 2. Manual reset type.
 - 3. Form C contacts.
 - 4. Sensing element of 20 ft minimum length.
 - 5. One sensor to cover 24 sq. ft. of protected area.
- I. Thermowell
- 1. When thermowells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and sensor.
 - 2. Thermowells shall be pressure rated and constructed in accordance with the system working pressure.

3. Thermowells and sensors shall be mounted in a direct mount (no adapter) offering faster installation or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
4. Provide brass thermowells for copper piping applications and stainless steel thermowells for steel piping applications.

2.02 PRESSURE SENSORS

- A. Duct Mounted Airflow Proving Switch
 1. Size to be determined by Contractor to accommodate requirements of application
- B. Duct Mounted High Static Safety Switch
 1. Size to be determined by Contractor to accommodate requirements of application.
 2. Manual reset type with SPDT contacts rated for 2 amps at 120VAC.
 3. Adjustable setpoint suitable for application.
- C. Duct Mounted Low Static Safety Switch
 1. Size to be determined by Contractor to accommodate requirements of application.
 2. Manual reset type with SPDT contacts rated for 2 amps at 120VAC.
 3. Adjustable setpoint suitable for application.
- D. Air Filter Status Switch
 1. Automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
 2. Suitable range and differential adjustment for intended service.
- E. Differential Pressure Transmitter
 1. General
 - a. Constructed to withstand 100% pressure over-range without damage and to hold calibration accuracy when subject to momentary 40% over-range input.
 - b. Transmit 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal
 - c. Sensors used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow permanent, easy-to-use connection.
 2. Low Differential Water pressure Applications (0 to 20 in. w.g.)
 - a. 4 to 20 mA linear output
 - b. 0.01 to 20 in. w.g. input differential pressure range
 - c. Maintain accuracy up to 20 to 1 ratio turndown
 - d. Accuracy: 0.2% of full span
 3. Medium to High Differential Water Pressure Applications (Over 21 in. w.g.)
 - a. Differential pressure range 10 in. w.g. to 300 PSI
 - b. Accuracy: +1% of full span (includes non-linearity, hysteresis, and repeatability)
 4. Building Differential Air Pressure Applications (-1 to +1 in. w.g.)
 - a. 4 to 20 mA linear output
 - b. -1.00 to +1.00 in. w.g. input differential pressure ranges. (Select range appropriate for system application)

- c. Maintain accuracy up to 20 to 1 ratio turndown
- d. Accuracy: +0.2% of full span
- 5. Low Differential Air Pressure Applications (0 to 2.5 in. w.g.)
 - a. 4 to 20 mA linear output
 - b. 0.00 to 5.00 in. w.g. input differential pressure ranges. (Select range appropriate for system application)
 - c. Maintain accuracy up to 20 to 1 ratio turndown
 - d. Accuracy: +0.25%, or 0.5% of full span
- 6. Medium Differential Air Pressure Applications (5 to 21 in. w.g.)
 - a. 4 to 20 mA linear output
 - b. 5.00 to 21.00 in. w.g. input differential pressure ranges. (Select range appropriate for system application)
 - c. Maintain accuracy up to 20 to 1 ratio turndown
 - d. Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 psig)
 - e. Thermal Effects: <+.033 F.S./°F. over 40°F to 100°F (calibrated at 70°F)

2.03 HUMIDITY SENSORS

A. General

- 1. The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.
- 2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.

B. Wall Mounted Sensor

- 1. Accuracy: 2% full range with linear output.
- 2. Operating range: 0 to 99% RH.

C. Wall Mounted Humidistat

- 1. Accuracy: 2% full range with linear output.
- 2. Operating range: 0 to 99% RH.
- 3. Provide with the following options when specified:
 - a. Humidity setpoint adjustment
 - b. Analog sensor
 - c. Integral LCD display with the following capabilities when specified:
 - 1). Display room humidity
 - 2). Display and adjust room comfort setpoint
 - 3). Setpoint override request via setpoint adjust dial or buttons
 - 4). Timed override request via occupancy override with status indication for activation of after-hours setpoint operation

- 5). Occupancy sensor status
- 6). Toggle between temperature and humidity
- d. Security Sensor: stainless steel cover plate with insulated back and security screws
- D. Duct Mounted Humidity Sensor
 - 1. Accuracy: 2% full range with linear output.
 - 2. Operating range: 0 to 99% RH.
 - 3. Constructed of 304 stainless steel with neoprene grommet, bushings, and mounting bracket
- E. Duct Mounted Humidity Switch
 - 1. Accuracy: 3% at 40% RH and 73°F.
 - 2. Setpoint Range: 20 to 90% RH.
 - 3. Constructed of 304 stainless steel with neoprene grommet, bushings, and mounting bracket
- F. Exterior
 - 1. Accuracy: 2% full range with linear output.
 - 2. Operating range: 0 to 99% RH.
 - 3. Weather resistant.
 - 4. Wind and sun shield.
 - 5. Enclosure suitable for outdoor temperatures of -20 to 110°F.

2.04 FLOW SENSORS

- A. Airflow Measuring Station – Duct Mounted
 - 1. General
 - a. Specification and design are based on thermal dispersion technology. Other technologies may be acceptable if comparable performance is demonstrated to the Engineer's satisfaction.
 - 2. Installed Accuracy
 - a. Airflow shall be +/- 3% of reading.
 - b. Temperature shall be +/- 0.15 °F.
 - 3. Calibrated Range
 - a. Sensor shall be calibrated for airstream velocities from 50 to 5,000 fpm.
 - 4. Operating Temperature
 - a. Probe shall be operable in airstream temperatures from -20 to 160 °F.
 - 5. Construction
 - a. Provided with air straightener for sizes over 17 square feet (1.6 sq. meters).
 - b. Fabricated of galvanized steel or aluminum casing of appropriate thickness for slip fits or with 90° connecting flanges in configuration and size equal to that of the duct into which it is mounted.

- c. Provide with an air directionalizer and parallel cell profile suppressor (3/4" maximum cell) across the entering air stream and mechanically fastened to the casing in such a way to withstand velocities up to 5000 feet per minute.
 - d. Probe(s) shall be constructed of an airfoil shaped aluminum extrusion containing the sensor circuit(s).
 - 6. Acceptable Manufacturers: Subject to compliance with requirements, provide Airflow measuring stations as manufactured by one of the following: Air Monitor Corporation, Ebtron, NJK Precision, or Paragon Controls Inc.
- B. Airflow Measuring Station – Fan Inlet
 - 1. General:
 - a. Provide differential pressure transducers of range appropriate for application.
 - b. Calibration of differential pressure reading and conversion to airflow value shall be the responsibility of the controls contractor.
 - c. Differential pressure transducer output shall be 4-20 mA
 - d. Differential pressure transducer shall include integral LCD display
 - e. Coordinate pressure fitting requirements with fan manufacturer's pressure sensing ports and tubing.
 - 2. Installed Accuracy
 - a. Differential pressure accuracy shall be +/-1% of full span
 - 3. Acceptable Manufacturers: Subject to compliance with requirements, provide Airflow measuring stations as manufactured by one of the following: Air Monitor Corporation, Paragon Controls Inc., Setra, or Veris.
- C. Airflow Measuring Sensor – Single Probe
 - 1. General
 - a. Adjustable insertion length up to 8".
 - b. 4 to 20 mA or 0 to 10 VDC linear output signal.
- D. Water Flow Switch
 - 1. Stainless steel or bronze paddle.
 - 2. Contractor to select appropriate range and differential adjustment for application.
 - 3. NEMA Type 1 enclosure.
 - 4. Bellows-actuated snap-acting type with pilot-duty rating, stainless steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 4 enclosure.

2.05 LEAK DETECTORS

- A. Provide spot leak detectors that can be secured to the floor or secured to a drain pan. The detection shall use a microchip controlled energized probes. The detector shall operate on 24V or less. Provide a way to adjust the height of the leak probes. The SPDT contacts shall be inside a watertight enclosure.

2.06 CURRENT SENSORS

- A. Current Switch
 - 1. Self-powered, with adjustable trip current.

2. Size to be determined by Contractor to accommodate voltage and current requirements of application.
3. Form C contacts
4. Comply with ISA 50.0.01, current-sensing fixed or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

B. Current Transducer

1. A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
 - a. 6X input over amp rating for AC inrushes of up to 120 amps
 - b. Manufactured to UL 1244
 - c. Accuracy: +.5%, Ripple +1%
 - d. Minimum load resistance 30kOhm
 - e. Input 0-20 amps
 - f. Output 4-20 mA
 - g. Transducer shall be powered by a 24 VDC regulated power supply (24 VDC +5%)
 - h. Acceptable manufacturers: Setra or approved equal

2.07 VOLTAGE SENSORS

A. Voltage Transmitter (100 to 600 VAC)

1. Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

2.08 OCCUPANCY SENSORS

A. Wall Mounted

1. Single wall switch with integral passive infrared sensor (PIR) technology shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
 - a. Acceptable Manufacturers: Hubbell #LHIRS1 Series, Leviton #ODS15-ID Series, Philips #LRS2210 Series, Sensor Switch #WSX Series, or Wattstopper #PW-100 Series.
2. Single wall switch with integral passive infrared sensor (PIR) technology and LED nightlight shall be 120 or 277 volt type, as required per Drawings, with 180 degree coverage.
 - a. Acceptable Manufacturers: Hubbell #LHN-IRS Series, Leviton #OSSNL-ID Series, Philips #LRS2230 Series, Sensor Switch #WSX-NL Series, or Wattstopper #PW-103N Series.
3. Dual wall switch with integral passive infrared sensor (PIR) technology and LED nightlight shall be 120 or 277 volt type, as required per Drawings, with 180 degree coverage.
 - a. Acceptable Manufacturers: Hubbell (not available), Sensor Switch #WSX-2P-NL Series, or Wattstopper #CS-350-N Series.
4. Single wall switch with integral dual technology sensor (PIR and ultrasonic) shall be universal line voltage type with adaptive learning technology and 180 degree coverage.

- a. Acceptable Manufacturers: Hubbell #LHMTS1 Series, Leviton #OSSMT-MD Series, Philips #LRS2220 Series, Sensor Switch #WSX-PDT Series, or Wattstopper #DW-100 Series.
- 5. Dual wall switch with integral dual technology sensor (PIR and ultrasonic) shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
 - a. Acceptable Manufacturers: Hubbell #LHMTD2 Series, Leviton #OSSMD-MT Series, Philips #LRS2225 Series, Sensor Switch #WSX-PDT-2P Series, or Wattstopper #DW-200 Series.
- 6. Single wall switch with integral passive infrared sensor (PIR) technology with 0-10V dimming capabilities shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
 - a. Acceptable Manufacturers: Hubbell #LHD-IRS Series, Sensor Switch #WSX-D Series, or Wattstopper #PW-311 Series.
- 7. Single wall switch with integral dual technology sensor (PIR and ultrasonic) with 0-10V dimming capabilities shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
 - a. Acceptable Manufacturers: Sensor Switch #WSX-PDT-D Series or Wattstopper #DW-311 Series.
- B. Ceiling Mounted
 - 1. Ceiling mounted passive infrared sensors (PIR only) technology sensors shall be low voltage type with adaptive learning technology, 360 degree coverage area of 1000 square feet minimum, isolated relay for use by BAS system and integral light level sensor.
 - a. Acceptable Manufacturers: Hubbell #OMNIIRP Series, Leviton #OSC15-IOW Series, Philips #LRM2250 Series, Sensor Switch #CM-10-R-P Series, or Wattstopper #CI-300 Series.
 - 2. Ceiling mounted dual technology sensors (PIR and ultrasonic) shall be low voltage type with adaptive learning technology, 360 degree coverage area of 1000 square feet minimum, isolated relay for use by BAS system, and integral light level sensor.
 - a. Acceptable Manufacturers: Hubbell #OMNIDTRP Series, Leviton #OSC10-M, Philips #LRM2255 Series, Sensor Switch #CM-PDT-9-R-P Series, or Wattstopper #DT-300 Series.

2.09 CARBON DIOXIDE SENSORS

- A. Wall Mounted
 - 1. Suitable over a temperature range of 20 to 120°F
 - 2. Calibrated for 0 to 2 percent, with continues or averaged reading
 - 3. 4 to 20 mA output
 - 4. Provide with the following options when specified:
 - a. Security Sensor: stainless steel cover plate with insulated back and security screws
- B. Duct Mounted
 - 1. Suitable over a temperature range of 20 to 120°F
 - 2. Calibrated for 0 to 2 percent, with continues or averaged reading

3. 4 to 20 mA output

2.10 RELAYS

- A. Size to be determined by Contractor to accommodate voltage and current requirement of application.
- B. Control Pilot Relays
 1. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
 2. Mounting Bases shall be snap-mount.
 3. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
 4. Contacts shall be rated for 10 amps at 120VAC.
 5. Relays shall have an integral indicator light and check button.
- C. Lighting Control Relays
 1. Lighting control relays shall be latching with integral status contacts.
 2. Contacts shall be rated for 20 amps at 277 VAC.
 3. The coil shall be a split low-voltage coil that moves the line voltage contact armature to the On or Off latched position.
 4. Lighting control relays shall be controlled by:
 - a. Pulsed Tristate Output – Preferred method.
 - b. Pulsed Paired Binary Outputs.
 - c. A Binary Input to the Facility Management System shall monitor integral status contacts on the lighting control relay. Relay status contacts shall be of the “dry-contact” type.
 5. The relay shall be designed so that power outages do not result in a change-of-state, and so that multiple same state commands will simply maintain the commanded state. Example: Multiple Off command pulses shall simply keep the contacts in the Off position.

2.11 TRANSFORMERS AND POWER SUPPLIES

1. Size to be determined by Contractor.
2. Coordinate electrical connections with Electrical Contractor.
3. Power supplies for controllers shall be a transformer with a fuse or circuit breaker. Power supplies for other devices can be plain transformers.

PART 3 EXECUTION

3.01 CONTROL DEVICE

- A. For each control device (i.e. sensor, switch, actuator, terminal strip, relay, etc.) provide and install an adhesive laminated label which clearly and uniquely identifies device.
- B. Control device labeling shall be coordinated with as-built wiring diagrams, such that any device can be referenced to the wiring diagrams.
- C. Include the following (as a minimum)
 1. Device Identifier
 2. Controlling/monitoring controller
 3. Power source

3.02 WIRING IDENTIFICATION

- A. Label all Controller I/O wiring at each end (controller and device) with an identifier which clearly indicates controller and terminating point number.

3.03 PANEL NAMEPLATES

- A. Permanently adhere nameplates on all control system cabinets.

3.04 TRANSFORMERS

- A. For each control transformer, clearly note the following
 1. Power Source (including panel name, location, and circuit number)
 2. Device(s) served.

END OF SECTION 23 09 13

SECTION 23 93 20
ELECTRONIC CONTROL VALVES AND ACTUATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SCOPE

- A. This Section specifies electric control valves and valve actuators, and includes general descriptions and installation methods.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all work described in this Section.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 GENERAL

- A. All control valves shall be factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of the piping system, unless indicated otherwise.
- B. Valves for two-position isolation applications shall be either standard ball valves or butterfly valves. Two-position isolation valves shall be full port line size.
- C. Valves for modulating applications shall be either characterized ball valves or globe valves.
- D. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional (except as noted).
- E. Subject to project requirements, provide actuators as manufactured by one of the following: Belimo Aircontrols, Inc. or Siemens.
- F. All actuators shall be by a single manufacturer unless approved otherwise by Engineer.

2.02 STANDARD BALL VALVE

- A. Valve Body:
 - 1. NPS 2" and Smaller:
 - a. Nickel-plated forged brass body rated at no less than 400 psi, stainless steel ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-ring packing design, and fiberglass reinforced Teflon seats.
 - b. NPS ¾" and Smaller for Terminal Units: Nickel plated forged brass body rated at no less than 600 psi, chrome plated brass ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-Ring packing design, and graphite reinforced PTFE seats.
 - 2. NPS 2-1/2" to 4"
 - a. Forged brass body with ASME 150 ductile iron flanges with stainless steel ball and blowout proof stem, rotating flanges, with a dual EPDM O-ring packing design, and fiberglass reinforced Teflon seats.

- B. Sizing:

1. Two-Position: Line size or size using a pressure differential of 1 psi.
- C. Close-Off Pressure Rating:
1. NPS 1" and larger: 100 PSI
 2. NPS ¾" and Smaller for Terminal Units: 200 PSI.
- D. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory with a single screw on a four-way DIN mounting-base.

2.03 CHARACTERIZED BALL VALVE

- A. Valve Body:
1. NPS 2" and Smaller:
 - a. Nickel-plated forged brass body rated at no less than 400 psi, stainless steel ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL flow characterizing disc.
 - b. NPS ¾" and Smaller for Terminal Units: Nickel plated forged brass body rated at no less than 600 psi, chrome plated brass ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-Ring packing design, graphite reinforced PTFE seats, and a TEFZEL flow characterizing disc.
 2. NPS 2-1/2" to 4"
 - a. Forged brass body with ASME 150 ductile iron flanges with stainless steel ball and blowout proof stem, rotating flanges, with a dual EPDM O-ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL flow characterizing disc.
- B. Sizing:
1. Two-Way Modulating: 5 psig or twice the load pressure drop, whichever is more. Size valve for 50% valve authority
 2. Three-Way Modulating: Twice the load pressure drop, but not more than 5 psig.
- C. Close-Off Pressure Rating:
1. NPS 1" and larger: 100 PSI
 2. NPS ¾" and Smaller for Terminal Units: 200 PSI.
- D. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory with a single screw on a four-way DIN mounting-base.

2.04 BUTTERFLY VALVES

- A. Valve Body (2" to 20" resilient seat ASME Class 125/150 Flanged):
1. Cast iron bodies meeting ASTM A126 Class B requirements, ASME class 125/150 flange requirements, and fully lugged.
 2. Valves seats shall be EPDM.
 3. Valves disks shall be ductile iron with Nylon 11 coating.
 4. Valves stems shall be stainless steel.
- B. Flow characteristics shall be of equal percentage up to 70 degrees of disk rotation.
- C. Valves shall be maintenance free.
- D. Valves shall be provided with a 3 year warranty.
- E. Valves shall be UL-recognized and CSA-certified.

F. GLOBE VALVES (1/2" THROUGH 2")

- G. Valve Body:
 - 1. Brass body with stainless steel stem.
 - 2. Valves with brass plugs and seats shall have stem seals with self-adjusting Ethylene Propylene Rubber (EPR) Ring Pack U-Cups.
 - 3. Valves with stainless steel plugs and seats shall have valve stem seals with spring loaded PTFE and Elastomer V-Rings.
- H. Flow characteristics shall be of equal percentage for two-way valves and linear for three-way valves.
- I. Valves shall meet the pressure and temperature requirements of ANSI B16.15, Class 250.
- J. Valves with brass trim shall have a maximum leakage specification of 0.01% of maximum flow per ANSI/FCI 70-2, Class 4.
- K. Valves with stainless steel trims shall have a maximum leakage of 0.05% of maximum flow.
- L. Valves shall be serviceable without being removed from the pipe.
- M. Valves shall be provided with a 3 year warranty.
- N. Valves electric actuators shall be UL-recognized or CSA-certified.

2.05 GLOBE VALVES (2-1/2" TO 6")

- A. Valve Body:
 - 1. Bodies shall be manufactured from cast iron.
 - 2. Valve stems shall be manufactured from 316 series stainless steel.
 - 3. Valves shall have stem seals with Ethylene Propylene Terpolymer (EPT) Ring Pack U-Cups.
- B. Flow characteristics shall be equal modified linear.
- C. Valves shall meet the pressure and temperature requirements of ANSI B16.15, Class 125.
- D. Valves shall have a maximum leakage specification of 0.01% of maximum flow per ANSI/FCI 70-2, Class 3.
- E. Valves shall be serviceable without being removed from the pipe.
- F. Valves shall be provided with a 3 year warranty.
- G. Valve electric actuators shall be UL-recognized or CSA-certified.

2.06 ACTUATORS:

- A. Electronic Actuators:
 - 1. Valve Actuator Sizing: Size for torque required for valve close off at 150 percent of total system (head) pressure for two-way valves; and 100 percent of pressure differential across the valve or 100 percent of total system (pump) head differential pressure for three-way valves.
 - 2. Select running and break away torque ratings to allow the actuator to close while the system is operational for all applications.
 - 3. Coupling: Directly couple end mount to stem, shaft, or ISO-style direct-coupled mounting pad.
 - 4. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
 - 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to deactivate the actuator at the end of rotation.

6. Fail-Safe Operation: Mechanical, spring-return mechanism.
 7. Power Requirements (Two-Position Spring Return): 24 Vac unless noted otherwise
 8. Power Requirements (Modulating): 10 VA at 24 VAC or 8 W at 24 VDC.
 9. Temperature Rating: -20°F to 120°F
 10. Proportional Signal: 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.
 11. Run Time: 12 seconds open, 5 seconds closed.
 12. Housing: Minimum requirement NEMA type 2 / IP54 mounted in any orientation.
 13. Agency Listing: ISO 9001, cULus, and CSA C22.2 No. 24-93.
 14. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
 15. Unless approved by the Engineer, all actuators shall be supplied by only one of the following approved manufacturers: Belimo, Siemens, Honeywell, or Johnson Controls.
- B. Position Indicators
1. Electric Valve Position Indicator:
 - a. Visual scale indicating percent of travel and 2 to 10 VDC feedback signal.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. Install valves and actuators in strict accordance with the manufacturer's recommendations.
- B. Ensure that adequate clearance is maintained to allow future testing, adjusting, calibration, servicing, and replacement of valve and actuator.

3.02 CONNECTIONS

- A. Complete all connections to all control valves and actuators required for a complete and functional system.

3.03 STARTUP, TESTING AND ADJUSTING

- A. Test and adjust valve in strict accordance with the manufacturer's recommendations.

END OF SECTION 23 93 20

SECTION 23 93 30
ELECTRONIC CONTROL DAMPERS AND ACTUATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The other Specifications of this Division complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies requirements for the purchase and installation of Control Dampers. This section does not apply to Smoke Dampers or Combination Fire/Smoke Dampers, which are specified separately.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all Control work described in this Section.

1.03 CODES AND STANDARDS

- A. Dampers shall be rated in accordance with:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers and Shutters
 - 2. AMCA 511 - Certified Ratings Program for Air Control Devices

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide dampers as manufactured by one of the following: American Warming and Ventilating, Arrow United, Greenheck, Ruskin, or Tamco.

2.02 GENERAL

- A. Automatic dampers shall be single blade or multiple blades as applicable.
- B. All dampers are sized on the drawings.
- C. All dampers furnished integral with equipment by equipment manufacturers must meet the requirements listed in this section.
- D. Provide Parallel or Opposed blades as indicated on drawings, with a maximum blade width of 6 inches.
- E. Provide dampers which meet or exceed the pressure classification of the system in which they are installed.
- F. Provide with the following seal options when specified:
 - 1. Blade: Seals shall be rated for operation between -70 and 275°F, and shall be mechanically attached to the blade.
 - 2. Jamb: Flexible metal compression type.

- G. Unless noted otherwise, damper frame shall be 16 ga. galvanized steel (standard applications) or 316 stainless steel (applications where damper is exposed to moisture or other environmental conditions requiring stainless steel construction) formed into a 5 in. x 1 in. structural hat channel. Top and bottom frame members on dampers less than 17 in. high shall be low profile design to maximize the free area of these smaller dampers. Frame shall be 4-piece construction with 1 ½ in. (minimum) integral overlapping gusset reinforcements in each corner to assure square corners and provide maximum resistance to racking. Stainless steel frame is optional.

2.03 STANDARD STAMPED METAL "3V" BLADE DAMPERS

- A. Damper blades shall be 16 ga. galvanized steel (standard applications) or 316 stainless steel (applications where damper is exposed to moisture or other environmental conditions requiring stainless steel construction) strengthened by three longitudinal 1 in. deep V-grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening. Blade orientation is horizontal. 304 stainless steel blade is optional.

2.04 AIRFOIL BLADE DAMPERS

- A. Damper blades shall be airfoil shape galvanized steel double skin construction with 2 skins of 20 ga. (standard applications) or 316 stainless steel double skin construction with 14 ga. equivalence (applications where damper is exposed to moisture or other environmental conditions requiring stainless steel construction). Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening. Blade orientation is horizontal. Stainless steel blade is optional.

2.05 AIRFOIL BLADE DAMPERS, ALUMINUM CONSTRUCTION

- A. Damper blades shall be heavy gauge extruded aluminum airfoil shape with metal blade to blade overlap. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening. Blade orientation is horizontal.

2.06 INSULATED AIRFOIL BLADE DAMPERS

- A. Damper blades shall be airfoil shape heavy gauge extruded aluminum double skin construction (14 ga. equivalence) filled with ½ in. polystyrene on each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening. Blade orientation is horizontal. Stainless steel blade is optional.

2.07 THERMALLY BROKEN BLADE DAMPERS

- A. Damper blades shall be heavy gauge extruded aluminum airfoil shape with metal blade to blade overlap. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Blade orientation is horizontal, and operation is parallel or opposed. Polyurethane foam fills the airfoil blade cavity giving the blade its thermal transfer properties. Ends of blade have a thermal break to isolate the transfer of heat/cold through the aluminum material from one side of the blade to the other.

2.08 THERMALLY BROKEN BLADE AND FRAME DAMPERS

- A. Damper blades shall be heavy gauge extruded aluminum airfoil shape with metal blade to blade overlap. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Blade orientation is horizontal, and operation is parallel or opposed. Polyurethane foam fills the airfoil blade cavity giving the blade its thermal transfer properties. Ends of blade have a thermal break to isolate the transfer of heat/cold through the aluminum material from one side of the blade to the other.
- B. Damper frame shall be aluminum formed into a 5 in. x 1 in. structural hat channel. Top and bottom frame members on dampers less than 17 in. high shall be low profile design to maximize the free area of these smaller dampers. Frame shall be 4-piece construction with 1½ in. (minimum) integral overlapping gusset reinforcements in each corner to assure square corners and provide maximum resistance to racking.
- C. Quick connect damper frame shall be aluminum formed into a 4 in. x 1 in. structural hat channel with a 0.125 in. minimum wall thickness.
 - 1. Thermally broken with dual polyurethane resin gaps.
 - 2. Quick connect mounting is a flangeless frame ordered oversized to mate with a connecting duct.

2.09 ACTUATORS

- A. Electronic Actuators:
 - 1. Damper Actuator Sizing: Size for torque as outlined below:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 - 2. Select running and break away torque ratings to allow the actuator to close while the system is operational for all applications.
 - 3. Coupling: Directly couple end mount to stem, shaft, or ISO-style direct-coupled mounting pad.
 - 4. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
 - 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry without the use of end switches to deactivate the actuator at the end of rotation.
 - 6. Fail-Safe Operation: Mechanical, spring-return mechanism.
 - 7. Power Requirements (Two-Position Spring Return): 24 Vac unless noted otherwise
 - 8. Power Requirements (Modulating): 10 VA at 24 VAC or 8 W at 24 VDC.
 - 9. Temperature Rating: -20°F to 120°F
 - 10. Proportional Signal: 2 to 10 VDC or 4 to 20 mA, and 2 to 10 VDC position feedback signal.
 - 11. Run Time: 12 seconds open, 5 seconds closed.

12. Housing: Minimum requirement NEMA type 2 / IP54 mounted in any orientation.
13. Agency Listing: ISO 9001, cULus, and CSA C22.2 No. 24-93.
14. Where required to successfully implement the Sequence of Operations, furnish dampers with integral end switches and/or analog feedback as indicated.
15. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
16. Unless approved by the Engineer, all actuators shall be supplied by only one of the following approved manufacturers: Belimo, Siemens, Honeywell, or Johnson Controls.

B. Position Indicators

1. Electric Damper Position Indicator:
 - a. Visual scale indicating percent of travel and 2 to 10 VDC feedback signal.

PART 3 EXECUTION

3.01 GENERAL

- A. Install Control Dampers as indicated on plans, and as required to successfully implement Sequence of Operations.

3.02 COORDINATION

- A. Coordinate damper locations with ductwork, and ensure that proper service access is maintained.

3.03 INSTALLATION

- A. Install dampers in accordance with manufacturer's installation instructions.
- B. Install dampers square and free from racking.
- C. Do not compress or stretch damper frame into duct or opening.
- D. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.04 ADJUSTING, CLEANING AND PROTECTION

- A. Adjust damper so it can be cycled through entire range of operation with no binding or sticking.

END OF SECTION 23 93 30

SECTION 23 94 30
HYDRONIC ENERGY MEASUREMENT SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 25 Specifications complement the requirements of this Section.

1.02 SCOPE

- A. This section specifies basic requirements for walls, roof and floor penetrations.
- B. Furnish all equipment, materials, labor, and supervision necessary to make all required mechanical penetrations as described herein.

1.03 CODES AND STANDARDS

- A. Ohio Building Code (OBC)
- B. National Electric Code (NEC)
- C. Underwriters' Laboratory (UL)
- D. National Institute of Standards and Technology (NIST)

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.
- C. Start-up Report:
 - 1. Provide completed start-up form, per the requirements of Section 23 03 20.
- D. Shop Drawings
 - 1. Provide Shop Drawings for hydronic energy measurement systems.
 - 2. Shop Drawings shall contain the following information:
 - a. General:
 - 1). Model Number
 - 2). Dimensions
 - 3). Weight
 - 4). Clearance requirements
 - 5). Special rigging requirements
 - 6). Material
 - 7). Color and finish
 - 8). Installation recommendations
 - 9). Ratings
 - 10). All included options and accessories
 - b. Performance:
 - 1). Performance data as scheduled and/or specified (at a minimum)
 - 2). Code\standard compliance information
 - 3). Pressure drop curve or chart
 - c. Connections:
 - 1). All pipe connections, including:
 - a). Size(s)

- b). Location(s)
 - c). Connection service
 - d). Connection method
 - 2). Electrical connections:
 - a). Location(s)
 - b). Termination lug size(s)
 - d. Electrical:
 - 1). Performance, including:
 - a). Voltage
 - b). Full Load Amps
 - c). Required overcurrent protection
 - d). Horsepower of motor(s)
 - 2). Power wiring diagram
 - 3). Starters
 - 4). Disconnect
 - e. Controls:
 - 1). Wiring terminations for required interlock and control wiring
 - 2). Wiring diagram, with factory installed and field installed portions clearly differentiated.
 - 3). Thermostat
 - 4). Sequence of operations
 - 5). Integration
 - a). Protocol, including baud rate
 - b). Available points, with read/write capabilities clearly noted.
 - f. Special
 - 1). Accuracy and repeatability data.
- E. Test and Startup Reports
 - 1. Equipment Startup Form (25 04 20a)
- F. Operation and Maintenance Manuals
 - 1. O&M Manuals shall include the following:
 - a. Final approved shop drawings, with Engineer's approval attached
 - b. All applicable start-up documents
 - c. All applicable test reports
 - d. Manufacturer's maintenance instructions, including:
 - 1). Recommended maintenance frequency
 - 2). Trouble shooting guide
 - 3). Spare parts lists
 - e. Special warranty information.
 - f. A copy of the NIST traceable factory calibration certificate

1.05 WARRANTY

- A. All equipment shall be covered by the manufacturer's two year warranty.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Onicon
- B. Hoffer Flow Controls
- C. Flow Technology

2.02 GENERAL

- A. The entire energy measurement system shall be built and calibrated by a single manufacturer.
- B. The system shall consist of a flow meter, two temperature sensors, a Btu meter, temperature sensor thermowells, and all required mechanical installation hardware.
- C. A certificate of NIST traceable calibration shall be provided with each system.

2.03 FLOW METER

- A. Insertion type flow meters shall be provided with all installation hardware necessary to enable insertion and removal of the meter without system shutdown
- B. Flow meters shall be hand insertable up to 400 psi.
- C. Flow meter shall be a dual turbine design, with two contra-rotating axial turbines.
- D. Turbine revolutions shall be sensed via an electronic, impedance-based sensing and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
- E. Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to NIST*.
- F. A certificate of calibration shall be provided with each flow meter.
- G. Accuracy:
 - 1. Within $\pm 0.5\%$ of rate at the calibrated velocity
 - 2. Within $\pm 1\%$ of rate over a 10:1 turndown (3.0 to 30 ft/s)
 - 3. Within $\pm 2\%$ of rate over a 50:1 turndown (from 0.4 to 20 ft/s).
- H. Output signal shall be a 0-15 V square wave pulse.

2.04 TEMPERATURE SENSORS

- A. Temperature sensors shall be loop-powered current based (mA) sensors and shall be bath-calibrated and matched (NIST* traceable) for the specific temperature range for each application.
- B. The calculated differential temperature used in the energy calculation shall be accurate to within $\pm 0.15^\circ\text{F}$ (including the error from individual temperature sensors, sensor matching, input offsets, and calculations).

2.05 THERMOWELLS

- A. $\frac{1}{2}$ " NPT brass wells with junction box

2.06 BTU METER

- A. The Btu meter shall provide the following points both at the integral LCD and as outputs to the building control system:
 - 1. Energy Total
 - 2. Energy Rate
 - 3. Flow Rate
 - 4. Supply Temperature and Return Temperature.
- B. Output signals shall be serial network (protocol conforming to BACnet® MS/TP, BACnet/IP).

- C. Meter shall be furnished with an integral alphanumeric liquid crystal display with a minimum of 16 alpha character (0.2" high) resolution and 6 numeric character (0.4" high) resolution.
- D. Meter shall be furnish with an integral, non-volatile EEPROM memory for retention of all program parameters and totalized values in the event of a power loss.
- E. Each Btu meter shall be factory programmed for its specific application, and shall be re-programmable using the front panel keypad (no special interface device or computer shall be required).
- F. Accuracy:
 - 1. Differential temperature within +/-0.15 deg. F. over calibrated range
 - 2. Computing non-linearity within +/-0.05%

PART 3 EXECUTION

3.01 INSTALLATION

- A. Flow Meter
 - 1. The flow meter shall be installed either in the supply or return pipe of the system to be measured.
 - 2. Install per the manufacturer's instructions with particular attention to upstream and downstream straight pipe runs.
- B. BTU Meter
 - 1. Fasten meter to nearest wall, at approximately 5'-0" above finished floor.
 - 2. Install per NEC
- C. Temperature Sensors and Thermowells
 - 1. Install thermowells in supply and return piping as indicated on the drawings and per the manufacturer's installation instructions.

3.02 CONNECTIONS

- A. Piping
 - 1. Prepare flanged connections in piping system to accept installation of hydronic energy meter.
 - 2. Securely bolt meter in place, utilizing appropriate flange gasket material.
 - 3. Tighten bolts to torque range as recommended by the meter manufacturer.
 - 4. Allow, at a minimum, the manufacturer's straight pipe diameters upstream and downstream of the meter.
 - 5. Install temperature sensors in thermowells per sensor manufacturer's installation instructions.
- B. Controls
 - 1. Terminate control wiring as recommended by the meter manufacturer and per the NEC.

END OF SECTION 23 94 30

**SECTION 23 95 10
GENERAL PROGRAMMING REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The other Specifications of this Division complement the requirements of this Section.

1.02 SCOPE

- A. This Section specifies requirements for the purchase, installation, configuration, and implementation the Building Automation and Integration system.
- B. Provide all materials, equipment, labor and supervision necessary to install and perform all Control work described in this Section.

1.03 DEFINITIONS

- A. DDC - Direct Digital Control

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide Shop Drawings, per requirements of Section 23 01 10.
- B. Operation and Maintenance (O&M) Manuals:
 - 1. Provide manuals, per requirements of Section 23 01 40.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Provide all programming, graphic design, and point mapping to provide a fully functional and completed system to the Owner.

3.02 COORDINATION

- A. Coordinate final graphic layout with Owner.

3.03 SEQUENCES OF OPERATION

- A. Program each Niagara Framework Network Controller, and third-party ASC, PCU, device, etc., to perform the sequences of operation provided on the construction documents Provide all necessary hardware on each piece of equipment in order for the equipment to perform the specified sequence and to meet the requirements of the point lists.
- B. The Contractor shall be responsible for all control wiring connections, auxiliary devices and control wiring diagrams to complete the control system and attain the described sequence of operation.

3.04 GRAPHICS

- A. Graphical representation of controlled/monitored systems shall be developed by the Control Contractor.
- B. Graphics shall be customized to the facility.
- C. The graphics shall, at a minimum, provide the user the following pages with the following data/functionality:
 - 1. Overview page
 - a. Summary of current operation including:
 - 1). Overall building status (occupied/unoccupied) if applicable
 - 2). Number of current alarms

- 3). Outside air temperature and relative humidity
 - b. Provide links to:
 - 1). Floor Plan Pages
 - 2). Alarm Page
 - 3). System Pages
2. Floor Plan Pages (for each level of the facility). Pages shall be divided such that required information may be clearly presented.
 - a. Floor plan representation of the facility, with major pieces of equipment.
 - 1). User shall be graphically alerted to any equipment that is in a “critical alarm” condition.
 - b. Representation of Temperature Control Zones including
 - 1). Status (Occupied/Unoccupied), if applicable
 - 2). Temperature and humidity setpoints
 - 3). Actual zone temperature and humidity, with color coded indication of off-normal conditions.
 - 4). Links to Zone Pages
 - c. Alarm Summary
 - 1). Text summary of all alarms present for equipment/zones shown on page.
3. Alarm Page
 - a. List of all alarms with the ability to sort by:
 - 1). Active vs. Inactive alarms
 - 2). Severity level of alarm
 - 3). Area within the building associated with the alarm
 - 4). System associated with the alarm
 - 5). Time/day of alarm occurrence
4. System Pages
 - a. For each major controlled system, provide a page that summarizes the operation of the system.
 - b. Include a system diagram with all control and controlled devices and components clearly identified.
 - 1). User shall be graphically alerted to any equipment that is in a Critical or Emergency Alarm condition.
 - 2). Diagram shall display status of equipment.
 - 3). Diagram shall display reporting value of all sensors, transducers, and switches associated with the system.
 - 4). Diagram shall display the position of all control valves and dampers associated with the system.
 - c. Links to Equipment Pages
 - d. Link to balance report associated with the system, if applicable.
5. Zone Pages (for each Temperature Control Zone)
 - a. Summary of setpoints associated with the Zone.
 - b. Summary of actual Zone Operating conditions.
 - c. Link to System Page(s) associated with the Zone.
 - d. Link to trend data associated with the Zone.

6. Equipment Pages (For each piece of integrated or controlled equipment)
 - a. Summary of setpoints associated with the Equipment.
 - b. Summary of actual Equipment Operating conditions.
 - c. Summary of alarms associated with the Equipment.
 - d. Link to electronic copy of Approved Shop Drawings associated with the equipment, if applicable.
7. Energy Metering Page
 - a. Display information as outlined in Energy Metering Section below.

3.05 ALARMS

- A. System shall allow the Owner to configure alarm routing based on the following (at a minimum)
 1. Time of day
 - a. Include functionally for interfacing with staff schedules.
 2. System type
 3. Alarm Class (see below)
 4. Location of device in alarm
- B. System shall have the capability to route alarms in any of the following ways (or any combination thereof):
 1. Alarm to Graphic Screen
 2. E-mail
 3. Text Message
 4. Output to dedicated printer.
- C. See Graphics requirements above for Alarm Graphic Requirements.
- D. All alarms shall be stored by the System for a period of time adjustable by the Owner.
- E. Alarm Classes
 1. All alarms shall be given a class as defined below. Controls Contractor shall be responsible for assigning Alarm Class.
 - a. Mechanical - Attention required to ensure safe and efficient operation of mechanical systems.
 - b. Electrical - Attention required to ensure safe and efficient operation of electrical systems.
 - c. Critical - Abnormality that requires attention. Failure to resolve could lead to damage to equipment or property.
 - d. Emergency - Abnormality that requires immediate attention. Failure to resolve situation is a life safety issue, or could cause immediate damage to equipment or property.
 - e. Normal - All alarms shall be routed to this class.
 2. System shall allow the Owner to configure new alarms, and to adjust settings and/or class of new alarms.
- F. Configuration:
 - a. Controls Contractor shall configure alarm routing for 10 users.

3.06 TRENDS AND LOGS

- A. System shall allow the Owner to perform a Trend of any digital or analog input or output used by the system for control or monitoring. The system shall allow the owner to configure the following for each trend (at a minimum):
 - 1. Start time
 - 2. Stop time
 - 3. Sample rate
- B. System shall allow the Owner to configure Trends of any digital or analog input or output used by the system for control or monitoring in a continuous (rolling) manner. The system shall allow the owner to configure the following for each continues trend (at a minimum):
 - 1. Sample rate
 - 2. Number of samples to save
- C. System shall allow the Owner to export trend logs in .csv, and/or HTML format for external data analysis and review.

3.07 INTEGRATION

- A. General
 - 1. At a minimum, the points outlined in the specification below and/or indicated on the drawings shall be integrated for each piece of equipment. Additional points shall be integrated as required to successfully implement the Sequence of Operations.
 - 2. Operational, Alarm, and Fault Codes from the equipment manufacture shall be integrated into the BAS system. The Bas system shall automatically compare the alpha-numeric code with a table and return the text description to the Building Engineer.
- B. Communication Protocols
 - 1. Field Control Network (FCN) integration protocol shall be as specified below. Controllers shall natively communicate via the following specified protocol without the use of any translators or gateways.
 - a. BACnet MS/TP (ASHRAE 135-2010)
 - 2. Manufacturer-furnished Equipment Controllers
 - a. BACnet MS/TP (ASHRAE 135-2010)
 - b. ModBus
- C. This contractor shall integrate the following manufacturer provided equipment controllers into the new automation system as follows:
 - 1. Air handling units
 - 2. Rooftop units
 - 3. Variable frequency drives
 - 4. Existing Boilers
- D. This contractor shall also integrate the following special control systems into the new automation system:
 - 1. Laboratory control system
 - 2. Autopsy control system

3.08 SYSTEM SECURITY

- A. System shall have multiple security levels to grant users differentiating levels of access. The levels shall be, at a minimum:
1. Level One - Read access only
 2. Level Two - All previous levels, modify space temperature setpoints
 3. Level Three - All previous levels, modify system setpoints
 4. Level Four - Full access

END OF SECTION 23 95 10

**SECTION 23 99 10
SEQUENCES OF OPERATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. The other Division 23 Specifications complement the requirements of this Section.

Editor's Note: Include "C" if utilizing graphic sequences

- C. The Sequences of Operation are divided into multiple sections:
 - 1. 25 70 10 – General
 - 2. 25 70 11 – AHU
 - 3. 25 70 12 – Chilled Water Plant
 - 4. 25 70 13 – Heating Water Plant
 - 5. 25 70 14 – Miscellaneous

1.02 SCOPE

- A. This section defines the required operational sequences and characteristics of mechanical equipment.
- B. Sequences of operation are hereby defined as the manner and method by which controls function. Requirements for each type of control system operation are specified in this Section.
- C. The Controls Contractor (CC) – also called the Temperature Controls Contractor (TCC) shall provide all necessary sensors, programming, testing, adjusting, devices, materials, labor, etc., to facilitate implementation of these sequences of operation.
- D. Operating equipment, devices and system components required for control systems are specified in other Division 23 Sections of these specifications.

1.03 SUBMITTALS

- A. The Controls Contractor shall include written sequences of operation in the Controls Submittals. The Controls Contractor shall modify the sequences to accurately reflect any changes made to the Engineer's sequences during the vendor's detailed design of the temperature control system.

PART 2 SEQUENCE OF OPERATION

2.01 GENERAL

- A. Control sequences are outlined in a flow/logic diagram format. This is understood to be a representation of the system operation, and not a programming flow chart. The controls contractor is responsible for all programming required to implement the sequences outlined below.
- B. The CC shall coordinate all programming with the Owner. The CC shall review with the Owner all final control parameters (times, temperature, setpoints, etc.) prior to the completion of the project programming.
- C. All setpoint values shown herein shall be adjustable, and shall utilize a named variable for simplicity in future modifications.

2.02 LEAD/STAND-BY OPERATION

- A. Lead/standby operation shall be understood that only one piece of equipment operates at a time, with the other equipment is off. Upon failure of the lead equipment, the standby equipment shall be activated and become the lead. All such rotations shall generate an alarm.

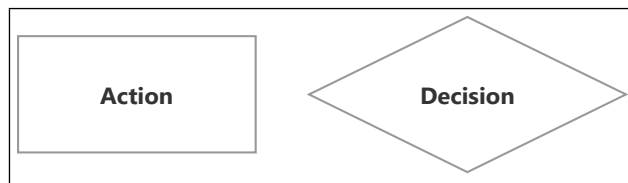
2.03 ALARMS

A. General:

Table 1: Alarm Levels

Alarm Level	General Description	Action
Low	Maintenance item that does not require immediate intervention	Report to alarm graphic screen (unit/system and main alarm screen)
Medium	Response is needed to provide proper operation of equipment	
High	Timely response is needed to prevent facility or equipment damage or loss of system control.	Report to alarm graphic screen (unit/system and main alarm screen) Email selected recipients

2.04 DEFINITIONS – LOGIC SYMBOLS



2.05 PACKAGED CONSTANT VOLUME ROOFTOP UNITS (RTU-##'S)

2.06 PACKAGED CONSTANT VOLUME ROOFTOP UNITS (RTU-##'S) WITH HGR

2.07 PACKAGED VAV ROOFTOP UNITS (RTU-##'S)

2.08 AIR HANDLING UNITS (AHU-##'S)

2.09 CHILLER PLANT AND DISTRIBUTION PUMPS

2.10 BOILER PLANT AND DISTRIBUTION PUMPS

2.11 TERMINAL BOXES

2.12 GENERAL EXHAUST FANS

2.13 HYDRONIC CABINET UNIT HEATERS

2.14 HYDRONIC UNIT HEATERS

2.15 DX DUCTLESS SPLIT SYSTEMS

2.16 GENERATOR INTERFACE

END OF SECTION 23 99 10

SECTION 26 00 51-BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. The work shall include the furnishing of systems, equipment, and materials specified in this Division and as called for on the Drawings, to include: supervision, operations, methods, and labor for the fabrication, installation, start-up, and tests for the complete electrical installation.
- B. Drawings for the work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangement and locations of the work. Because of the scale of the Drawings, certain basic items such as conduit fittings, access panels, sleeves, pull and junction boxes may not be shown. Where such items are required by Code or by other Sections, or where they are required for proper installation of the work, such items shall be included.
- C. Equipment Specification may not deal individually with minute items such as components, parts, controls and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for.

1.03 ELECTRICAL REFERENCE SYMBOLS

- A. Symbols used on the floor plans are defined in the Electrical Symbols Schedule on the Drawings. Not necessarily will all symbols scheduled be required for the project.
- B. The symbols used for schematic or one line power and control wiring diagrams are American Standard Graphical Electrical Symbols and are published in American Standard Chart Z32.3.

1.04 PERMITS, INSPECTIONS, AND CODES

- A. The Contractor shall secure and pay for all permits and inspections required by the governing authorities for the prosecution of the electrical work. All permits and certificates of inspection and approval signed by the controlling building department shall become the property of the Owner.
- B. All wiring shall be in compliance with the current edition of the National Electric Code, applicable State and City regulations, and OSHA. In cases of conflict between Code and Specifications, the more restrictive requirements shall govern.

1.05 VISIT TO THE SITE

- A. The Electrical Contractor shall be required to visit the site of the work and familiarize himself with all such conditions affecting the work. The submission of his bid proposal shall presuppose his knowledge of all such conditions.

1.06 WORKMANSHIP

- A. Employ only experienced craftsmen under direct supervision of a full time competent foreman.
- B. Keep fully informed as to progress of work, so that work of this Division may be built into place in sufficient time to insure against delay to other trades, and to prevent misalignments or damage to electrical work.
- C. All work shall be completed in a neat and workmanlike manner as described and illustrated in the ANSI standards publication "*NECA 1-2000 Standard Practices for Good Workmanship in Electrical Contracting*".

1.07 COORDINATION, CONDUCT, AND SCHEDULING OF WORK

- A. Electrical drawings are diagrammatic, indicating general arrangement, approximate sizes, general locations of equipment and outlets. Verify dimensions in field; adjust to manufacturer's shop drawings. Do not scale drawings.

- B. Architectural and structural drawings supersede electrical drawings. Determine that work of this Division can be accommodated within spaces provided. Notify Construction Manager and/or Architect of any interferences before starting installation.
- C. Determine sizes, locations for chases, openings necessary for installation of electrical work; cooperate with other trades in setting of sleeves, inserts, and hangers.
- D. Coordinate this work with all trades, serving utilities, and equipment suppliers. Arrange operation, submittal approvals, and equipment delivery, so as not to delay installation or completion of any parts of interrelated work so that construction may proceed on schedule.
- E. Cooperate with Mechanical trades in preparing interference drawings for points where there is possible conflict between trades. Exact locations of pipes, ducts, conduit based on field measurements with final arrangement to be determined by intra-trade agreements subject to Construction Manager's and/or Architect's review.
- F. Architect reserves the right to make reasonable changes in indicated locations without extra cost to the Owner.
- G. Drawings other than electrical drawings, and other sections of this Specification, may show or specify electrically operated equipment, wiring diagrams, etc. The Contractor shall examine all such drawings and specification sections and become familiar with the characteristics and required connections for all equipment.
- H. Conduits, wiring, and equipment shall be arranged substantially as indicated. Any change resulting in a savings in labor or material shall be made only in accordance with a contract change order. Deviations shall be made only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted to and approved by the Architect.
- I. Electrical Contractor shall coordinate and schedule all work to be provided by all electrical utility companies (CATV, telephone, etc.).
 - 1. All utility company charges shall be paid by owner and excluded from the Electrical Contractor's proposal.
 - 2. Notify the electrical engineer of any/all discrepancies or deviations from that work shown on the bid documents prior to execution of work.

1.08 MATERIALS

- A. All equipment and devices shall be new and shall conform to NEMA and Underwriters' Laboratories Standards. Where Specifications describe, or plans show, materials or equipment of higher quality than required by code and local ruling, the Drawings and Specifications shall govern the quality of the material or equipment.
- B. Materials and equipment used as extensions to existing special systems shall be of matching electrical characteristics for satisfactory operation of the complete system and shall be of the same manufacture and design unless otherwise approved.
- C. The Contractor shall submit proof, if requested by the Architect, that the materials, appliances, equipment or devices that he furnishes and installs under this contract, meet the requirements of the Underwriters' Laboratories, Inc. and its publications will be referred to hereinafter by the abbreviation UL, with or without additional identifying symbols.
- D. The National Electrical Code (NEC) of the National Fire Protection Association, and Publications and Standards of the organizations listed below are referenced herein by the abbreviations noted in parentheses, with or without additional identifying symbols. Unless otherwise specified, all work shall be manufactured, tested and installed in accordance with such reference standards.
 - 1. American Society for Testing and Materials (ASTM)
 - 2. Underwriters' Laboratories, Inc. (UL)
 - 3. Insulated Power Cable Engineers Association (IPCEA)

4. National Electrical Manufacturers Association (NEMA)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. American National Standards Institute, Inc. (ANSI)
7. National Fire Protection Association (NFPA)

1.09 GUARANTEE

- A. The Electrical Contractor shall guarantee for a period of one year that all work and equipment will remain free from all defects in workmanship and materials, and that it will comply with all the specific requirements of the Specifications and other Contract Documents governing the work.
- B. All work found to be defective will be replaced with new work meeting all the requirements of the Contract. The Electrical Contractor will bear all costs of supplying such new work, and installing and finishing same, and will assume all costs for replacing other work damaged by the removal and replacement of any of the work. The Electrical Contractor will bear all costs for freight, drayage and demurrage, and all labor in connection therewith.

1.10 SUBMITTALS

- A. This Contractor shall prepare or obtain from the manufacturer certified shop or erection drawings of the items listed below. After Contractor's review and approval of the proposed submittal, electronic copies of each shall be stamped and submitted to the Architect for approval before proceeding with installation or construction.
 1. All lighting fixtures shall be submitted at one time. These drawings shall be complete in every respect, showing pertinent details of size, capacities, ballasts, accessories, type and thickness of materials, weight, maintenance, features, etc.
 2. Submittal drawings for all electrical distribution equipment identified with an asterisk " * " in paragraph 1.10B below shall consist of factory generated shop drawings only (submittals developed by local sales agencies or local distributors are not acceptable and will be returned without review). Factory submittals shall minimally include the following information;
 - a. Dimensioned plan view and dimensioned elevations to define all sizes, shipping splits, rough-in areas, lifting eyes, mounting rails, required access, door swings, location of major components, etc.
 - b. Complete description of all power bus including physical size, bus configuration, bus elevations, bus dimensions, bus material, bus bracing, bus ampacities, etc.
 - c. Description of all materials (type and thickness), finishes, devices and accessories providing sufficient information (including a "bill-of-material" where applicable) to permit evaluation and determine compliance with Construction Documents.
 - d. Control schematics (where applicable).
 - e. Wiring diagrams.
 - f. Nameplate details and nameplate listing.
 - g. Listing of all applicable listings and construction standards.
 - h. Additional information as noted in the individual specification section.
- B. Approval drawings shall be submitted for the following items. Acceptable manufacturers shall be as described in the individual specification sections except where specifically noted below:
 1. 26 00 56 - Firestopping
 2. 26 01 40 - Wiring Devices and Plates

3. 26 01 54 - Fractional Horsepower Motor Starters
 - a. Allen Bradley "Bulletin 600"
 - b. Cerus "BAS-1P"
 - c. Cutler-Hammer "Type MS"
 - d. ABB/GE "CR101"
 - e. Siemens "Type SMF"
 - f. Square D "Class 2510"
4. 26 01 65 - Branch Circuit Panelboards
 - a. Cutler-Hammer "Pow-R-Line"
 - b. ABB/GE "AQ/AE/AD Series"
 - c. Siemens "P2" Series
 - d. Square D "NQ/NF"
5. 26 01 66 – Loadcenters
 - a. Eaton #BR1224L125RIS
 - b. Siemens #R1632L1125
 - c. Square D #QO112L125PWG
 - d. ABB PowerMark Gold Riser Panel
6. 26 01 70 - Disconnect Switches
 - a. Cutler-Hammer
 - b. ABB/GE
 - c. Siemens
 - d. Square D
7. 26 01 81 - Fuses
 - a. Bussmann
 - b. Littlefuse
 - c. Mersen
8. *26 02 16 - Standby Power Generation
9. *26 02 50 - Automatic Transfer Equipment
10. *26 04 61 - Dry Type Distribution Transformers
 - a. Acme Electric – 2016 DOE
 - b. Cutler-Hammer – 2016 DOE
 - c. Federal Pacific – 2016 DOE
 - d. ABB/GE – 2016 DOE
 - e. PowerSmiths – E-Saver 33L
 - f. Siemens – 2016 DOE
 - g. Square D – 2016 DOE
11. 26 05 01 - Lighting

12. 26 09 32 - Automatic Lighting Controls
 13. 26 36 00 – Manual Transfer Switch
- C. Electronic submittals shall conform to the following requirements:
1. Electronic submittals shall be in Portable Document Format (.pdf)
 - a. Electronic submittals shall include a transmittal.
 - b. All portions of the electronic submittal shall be bound in a single .pdf file.
 - c. All content of the submittal shall be visible/readable and shall clearly indicate each item to be reviewed. Indicate specific options or accessories on shop drawings by pointing to, checking off, underlining, or other means.
 - d. File shall be named to match submittal contents.
 - e. Submittals shall include a specific notice of any deviation from the Contract Documents.
 2. Electronic submittals shall include a Contractor review stamp that indicates review and approval by the Contractor prior to submission.
 3. Electronic submittals shall be transmitted via an email.
 - a. One submittal per email.
 - b. Email shall clearly contain project name and contents of submittal.
 4. Failure to conform to the requirements above may result in rejection.
 5. The Reviewer shall return the submittals in a format and method appropriate for the Project and the response.
- D. AutoCAD floor plans are available to Vendors and Contractors to assist in generation of shop drawings.
- E. Prior to the signing of the contract the successful bidder shall submit to the Architect a list of manufacturers of the major items of equipment he proposes to furnish and the names of any subcontractors he proposes to employ.

1.11 ENGINEER'S REVIEW

- A. Shop drawings shall be reviewed for general compliance. The Reviewer will make reasonable efforts to detect and correct errors, omissions and inaccuracies but shall not be responsible for failure to detect errors, omissions, or inaccuracies. Failure to detect errors, omissions, and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.
- B. The Engineer shall mark the shop drawings in one of the ways outlined below. See each description for interpretation of Engineers marks and Contractor responsibilities associated with each.
 1. APPROVED: The submittal complies with the requirements of the specifications.
 2. APPROVED AS NOTED: The submittal generally complies with the requirements of the specifications but some non-critical items which need to be corrected/coordinated are noted. The corrections shall be changed on the shop drawings submitted for inclusion in the Operations and Maintenance Manual. Re-submittal is not required unless noted otherwise.
 3. REVISE AND RESUBMIT: The submittal generally complies with the requirements of the specifications but some critical items which need to be corrected/coordinated are noted. The submittal must be revised and resubmitted with all comments addressed.

4. REJECTED: The submittal does not comply with the requirements of the specifications. The submittal must be revised and resubmitted.
- C. Approval of submittal items shall not eliminate the Engineers right to reject those items if defects are discovered prior to final acceptance of the completed work.

1.12 SUBSTITUTION

- A. Bidders desiring to make a substitution for the specified brand or method shall list such proposed substitution. In each case state the difference in price where substitution is offered. If there is no difference in price, so state.
- B. It shall be understood that the proposal submitted shall be based on the different branches of work and materials specified, and that the Owner is entitled to the use of the materials so specified. Substitution sheet shall be signed and dated by the Electrical Contractor and shall be formatted as follows:

BRAND OR MAKE SPECIFIED | PROPOSED SUBSTITUTION | ADD | DEDUCT

1.13 APPROVED WIRING SYSTEMS

- A. All raceways, conductors, and wiring systems furnished and installed under this project shall be restricted to that specifically described on the electrical construction drawings and/or the following Electrical Specification Sections.
 1. 26 00 53 General Wiring
 2. 26 01 11 Conduit Systems
 3. 26 01 20 Wire and Cable
- B. Unless specifically noted otherwise on the Electrical Bid Documents, the Electrical Contractor shall not install Type AC armored cable, Type FC flat cable, Type FCC flat conductor cable, Type MC metal-clad cable, Types NM / NMC / NMS nonmetallic sheathed cable, Types SE / USE service cable, or Type UF underground feed cable.

1.14 CONCRETE WORK

- A. Concrete bases and pads for electrical equipment identified on the Drawings or as required shall be the responsibility of this Section.
- B. Pads shall be 3" high with chamfered top edges unless otherwise noted on the Drawings. Pad sizes and locations shall be determined by the Electrical Contractor (do not scale from the Drawings).
- C. This Contractor shall furnish all equipment anchor bolts and shall be responsible for their proper installation and accurate location.

1.15 NAMEPLATES AND LABELS

- A. The Electrical Contractor shall furnish and install a system of nameplates designed to identify each piece of equipment, control unit thereon, and major distribution points. The following color scheme shall be used as a guide:
 1. For switchboards, panelboards, control centers, all panels and remote control and indicating devices served by "normal" power, use black plastic, laminated, with white engraved letters. For equipment served by "emergency" power, use red plastic, laminated, with white engraved letters.
 - a. Switchboard, distribution panelboard, branch circuit panelboard, and motor control center nameplates shall identify panel designation, voltage, and designation of upstream source:
 - 1). Line 1: "Panel 1-2A"
 - 2). Line 2: "208/120V, 3Ø, 4-wire"
 - 3). Line 3: "Fed from switchboard SDP-2A"

2. For fire alarm system cabinet and panels, use red laminated plastic with white engraved letters.
 3. For telephone distribution cabinets and panels, use black plastic with white engraved letters.
 4. Size of nameplates shall be made to readily differentiate between, and identify, equipment and usage. Nameplate identifying items that are transferred to emergency power shall carry a nameplate saying "EMERGENCY".
 5. Exposed feeder conduits shall be identified as to load fed and voltage (Normal or Emergency) with 1" high black stenciled letters and numerals; conduit shall be marked every 50 feet and at the supply end of the feeder. This shall include existing "spare" conduits.
- B. Nameplates for switchboards and panelboards shall be as shown on the drawings and as required in accordance with NEC 408.4(B).
 - C. Fasten nameplates to all enclosures by use of stainless steel sheet metal screws.
 - D. A label reading "contains emergency circuits" shall be installed on all boxes and enclosures that contain emergency powered circuits to comply with NEC 700.9(A).
 1. Labels shall be installed on front covers of all pullboxes, junction boxes, and control enclosures.
 2. Labels shall be installed on interior trim of all branch circuit panelboards.
 3. Labels shall be installed on front trim of each transfer switch.
 - E. The Electrical Contractor shall furnish and install Arc Flash Warning labels in a clearly visible location on the front trim of all switchboards, panelboards (inside the hinged panel cover), industrial control panels, meter socket enclosures, and motor control centers to comply with NEC 110.16. Labels shall be Brady Identification Solutions (1-800-537-8791) cat. no. 94913, 3.5" x 5", or equivalent.

1.16 PANELBOARD DIRECTORIES

- A. New panelboards shall be provided with typed directories indicating loads served from each branch circuit. Existing panelboard directories shall be updated to reflect all new branch circuit wiring installed and existing branch circuit wiring removed.
- B. Directories shall designate the type of load and room/area served.
 1. The load description shall indicate receptacle, lighting, or fixed pieces of equipment. Portable equipment shall not be used to identify a branch circuit (i.e. coffee pot, fax machine, computer, etc.).
 2. Room descriptions shall utilize the Owner's room numbers, not the architectural plan room numbers. Where no room number is assigned by the Owner, the description shall include the location and room usage (i.e. South Storage, Lounge, etc.).
 3. Room numbers and descriptions shall be approved in advance by the Owner.
- C. All unused branch circuit breakers shall be placed in the "off" position and the corresponding line on the directory shall be labeled "spare" with an erasable lead pencil.

1.17 CLEANING AND PAINTING

- A. Touch up and repair any damaged factory finishes on equipment and materials furnished. Other painting will be done under the Painting Division of the Specifications.
- B. Remove any rust spots and prime with rust inhibitive paint any metal surfaces of electrical devices not provided with rust inhibitive coatings. Then apply one coat of paint in color as directed by Architect.
- C. Swab interiors of conduits clean and dry before pulling wire. Clean interiors of boxes and cabinets before installing trims and covers.

1.18 TESTS

- A. Systems shall be tested by the Electrical Contractor and placed in proper working order prior to demonstrating systems to Owner.
- B. After work is completed a load balance test shall be made by the Electrical Contractor to demonstrate that with full lighting and mechanical load the balance between phases is within 5%. Unbalance beyond this limit shall be corrected. Special care shall be taken during load balance adjustments to assure that reverse rotation of motors does not occur.
- C. System ground shall be tested to demonstrate that the ground resistance does not exceed the requirements of NEC.
- D. Perform such tests as required by authorities having jurisdiction over the site.
- E. Perform tests as described in all subsequent specification sections.

1.19 DEMONSTRATIONS

- A. Prior to acceptance of the work, the Contractor shall demonstrate to the Owner or his designated representative all features and functions of all systems and shall instruct the Owner in the proper operation of the systems. Each system shall be demonstrated once.
- B. The demonstrations shall consist of not less than the following:
 - 1. Point out the actual location of each component of a system and demonstrate its function and its relationship to other components within the system.
 - 2. Demonstrate the electrical systems by actual "start-stop" operation showing how to work controls, how to reset protective devices, how to replace fuses, and what to do in an emergency.
 - 3. Demonstrate communication, signal, alarm, and detection systems by actual operation of the systems and show how to reset signal, alarm, and detection devices.
- C. Systems to be demonstrated shall include but not be limited to the following:
 - 1. Service and Power Distribution Systems
 - 2. Lighting and Lighting Controls Systems
 - 3. Emergency Lighting Systems
 - 4. Motor and Equipment Control
 - 5. Standby Power System
- D. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instruction, and shall arrange to have the manufacturer's representatives present to assist with the demonstrations.
- E. Contractor shall coordinate dates and times for performing all demonstrations with the Owner.

1.20 OPERATION AND MAINTENANCE MANUALS

- A. Electrical Contractor shall furnish to the Owner operation/maintenance manuals as described in the Division 1 Specifications.
- B. Manuals shall meet or exceed all Division 1 Specification requirements and shall minimally include three (3) individually bound and indexed (thumb tabbed) manuals. Each manual shall provide operating instructions, maintenance manuals, spare parts listing, copies of warranties, wiring diagrams, inspection procedures and shop drawings on all equipment and systems.
- C. An electronic copy of the all manuals shall also be provided on CD or DVD. Each manual shall consist of a separate bound PDF file arranged in the same order as the associated hardcopy.
- D. Unless otherwise directed by the Division 1 Specification each manual shall be bound in a heavy-duty, 3 inch, three-ring vinyl covered binder with pocket folders for drawings and folded sheet information. Each binder shall be identified on both the front and the spine.

1.21 AS-BUILT DRAWINGS

- A. As work progresses during the construction period, the Electrical Contractor shall record (on a dedicated set of bid drawings) any deviations from the design drawings. The completed record set of as-built drawings shall be delivered to the Architect prior to the Electrical Contractor's request for final payment.
- B. As-built documentation shall meet or exceed all Division 1 Specification requirements.

1.22 PROJECT CLOSE-OUT

- A. The installing Contractor shall contact the Engineers' office upon completion of the installation to request final inspection. At that time the following documents shall be assembled and provided for review at the job site:
 - 1. Photocopies of all branch panel schedules.
 - 2. Original (or carbonless copy) of signed hazardous waste disposal receipt from approved disposal facility for the following (where applicable):
 - a. PCB contaminated transformers
 - b. Fluorescent and HID lamps
 - c. Fluorescent and HID ballasts
 - 3. Photocopies of all signed electrical inspection permits.
 - 4. O & M Manuals (as described above).
 - 5. Photocopies of certified test results, as required by all specification sections.
 - 6. "As-Built" print set.
 - 7. "As-Built" flexible manufactured wiring system drawings where installed (Specification 26 04 73).
 - 8. Photocopy of the "spare fuse inventory" provided.
 - 9. Photocopy of Printout from Fire Alarm System listing device addresses and custom labels.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION - (NOT USED)

END OF SECTION 26 00 51

DATE: _____ **Date:** _____
PREPARED FOR: _____ **Company Name:** _____
PREPARED BY: PTA Engineering, Inc.
PROJECT: The Beechwood Apartments Renovations
PTA Project # 17-21-25

Requested Drawing Files: _____

PTA Engineering, Inc. is providing the attached electronic files for your use in the preparation of shop drawings related to the above-referenced project and conditionally upon your acceptance of the following terms and conditions. By receiving, accessing and downloading this information, you agree to accept the following Terms and Conditions:

PTA Engineering, Inc. Terms and Conditions for Electronic Files Transfer

1. PTA Engineering, Inc. makes no representation as to the compatibility of these files with your hardware or your software.
2. Data contained on these electronic files is part of our instruments of service and shall not be used by you or anyone else receiving this data for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to PTA Engineering, Inc. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents, or sub-consultants that may arise out of or in connection with your use of the electronic files.
3. The Contractor/Vendor shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or cost, including attorneys' fees and defense costs, arising out of or resulting from the use of these electronic files.
4. These electronic files are not construction documents. Differences may exist between these electronic files and current construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between sealed hard-copy construction documents prepared by us and the electronic files, the signed or sealed hard-copy construction documents shall govern, unless you are directed otherwise in writing by our office. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors/vendors for the project.
5. Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indication of ownership and/or involvement from each electronic display.
6. Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by use, and we make no warranties, either expressed or implied, of merchantability and fitness of any particular purpose. In no event shall we be liable for any loss of profit or any consequential damages as a result of your use or reuse of these electronic files.

Acceptance of Contractor/Vendor:

Signature: _____ Title: _____
Printed Name: _____ Date: _____

SECTION 26 00 53-GENERAL WIRING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide materials, equipment, labor, and supervision necessary to install feeder, branch, control, and system circuits as required by the Drawings and this Section, to include:
 1. Conductors
 2. Conduit Fittings and Boxes
 3. Overcurrent Protection
 4. Panelboards
 5. Conduit Hangers and Supports
 6. Wiring Devices
 7. Motor and Equipment Connections

1.03 STANDARDS AND CODES

- A. Methods of fabrication and installation shall comply with the provisions of applicable articles in the NEC.
- B. Materials shall be UL and NEC approved for the application intended.

PART 2 PRODUCTS

2.01 RELATED EQUIPMENT AND MATERIAL

- A. The equipment and material related to feeder and branch circuit systems as called for on the Drawings and specified in the electrical specifications.
- B. The materials used in the installation of general wiring shall be products of manufacturers regularly engaged in the manufacturing of the specified material. Where a manufacturer is named for a particular material, the material of other manufacturers will be accepted provided the material meets requirements of the Specification.

2.02 APPROVED WIRING SYSTEMS

- A. All raceways, conductors, and wiring systems furnished and installed under this project shall be restricted to that specifically described on the electrical construction drawings and/or in the electrical specifications.
- B. Unless specifically noted otherwise on the Electrical Bid Documents, the Electrical Contractor shall not install Type AC armored cable, Type FC flat cable, Type FCC flat conductor cable, Type MC metal-clad cable, Types NM / NMC / NMS nonmetallic sheathed cable, Types SE / USE service cable or Type UF underground feed cable.

PART 3 INSTALLATION

3.01 GENERAL

- A. All wiring shall be furnished and installed complete from point of service connection to all receptacles, lighting fixtures, clocks, fans, power outlets and outlets for future extensions, etc., as indicated on the drawings. Ample slack wire shall be provided for motor loops, service connections, etc. Unless otherwise specified, all branch circuit conductors shall be # 12 AWG or larger. In outlet boxes for future installation of devices, ends of wires shall be taped and tagged for identification at both ends and outlets supplied with blank covers.

- B. All conductors not larger than #10 located in branch circuit panelboards, signal cabinets, signal control boards, switchboards and motor control centers shall be neatly and securely bundled. All conductors larger than #10 located in switchboards, motor control centers and pull boxes shall be neatly and securely cabled in individual circuits. Bundling and cabling shall be done with either (1) marlin twine or 3 ply lacing or (2) nylon straps made of self-extinguishing nylon having temperature range of 65°F to 350°F. Each strap shall be constructed with a locking hub or head on one end and a taper on the other. Arcproofing, where required on feeders shall be applied after cabling.
- C. Raceways subjected to different temperatures and where condensation may be a problem shall be filled with an approved material to prevent circulation of warm air to a colder section of the raceway. This shall include, but not be limited to, raceways passing from interior to exterior of buildings and raceways entering switch and control enclosures located outdoors.
- D. Branch circuit wiring within fixture wireways of multiple unit sections or surface, recessed or pendant type fluorescent lighting fixtures shall be minimum #12 AWG stranded XHHW or THHN.

3.02 FEEDER CIRCUITS

- A. A riser diagram and/or a general layout of feeder circuits are indicated on the Drawings. Contractor shall install the feeders generally as indicated, but shall determine the exact location and routing of feeders to best fit the field conditions.
- B. In general, conductor sizes for feeder circuits are noted on the Drawings. Where conductor sizes for feeder circuits are not shown, the Contractor shall immediately notify the Engineer, who in-turn, will provide the missing information and further directives.
- C. Feeder conductors shall be routed continuous from origin to destination, without splicing, unless specifically noted otherwise on plans.
- D. Refer to Section 260120 for feeder conductor insulation, color coding, connectors, and support requirements.

3.03 BRANCH AND SYSTEM CIRCUITS

- A. A general layout of branch circuit wiring is indicated on the Drawings. Generally, receptacles and appliances shall be on separate circuits from lighting.
- B. Branch panel circuits are numbered to match NEMA pole numbering system; poles 1 and 2 - Phase A, poles 3 and 4 - Phase B, poles 5 and 6 - Phase C, etc.
- C. Where homerun circuit numbers are shown on drawings, such numbers shall be followed in connecting circuits to panelboards. Each branch circuit homerun containing two or more circuits with a common neutral shall be connected to the circuit breakers or switches in such a manner that no two of the circuits will be fed from the same phase.
 - 1. In general, 120V and 277V single phase circuits shall be provided with dedicated neutrals and connected to single pole breakers.
 - 2. Where multi-wire circuits are installed for modular type furniture, multi-circuit plug mold and similar equipment with a common neutral, phase conductors shall be connected to a multi-pole breaker.
- D. Each feeder and branch circuit associated with a two-pole or three-pole protective device shall be provided with a separate green insulated equipment grounding conductor. The required equipment grounding conductor shall be sized as shown on the drawings and shall not be smaller than shown in NEC Table 250.122 and shall be installed in a common conduit with the related phase and/or neutral conductors. In the case of parallel feeders, each raceway shall have a full size green insulated equipment ground conductor.
- E. Where panelboard cabinets are recessed, conduits with sufficient capacity to carry the required number and size of future conductors for all spare branch circuit protective devices and spaces in the panelboard shall be stubbed out above accessible ceilings. In no case shall there be less than one 1" and three 3/4" conduits stubbed out.

- F. Branch circuit conductor sizes shall minimally be #12 AWG. Where the length of a homerun, from panel to first outlet, exceeds 75 feet for a 120 volt circuit or 175 feet for a 277 volt circuit, the minimum conductor size shall be #10 AWG.
- G. In general, conductor sizes for larger branch circuits, such as motor and equipment branch circuits, are noted on Drawings. Where conductor sizes for such circuits are not noted, Contractor shall provide branch circuit conductors sized as follows:
 - 1. Conductors for individual motor branch circuits shall have ampere capacity of not less than 125% of the running current of the motors (Article 430.22, NEC).
 - 2. Conductors for multiple motor branch circuits shall have ampere capacity of not less than 125% of the running current of the largest motor plus 100% of the running current for each additional motor connected to the circuit (Article 430.24, NEC).
 - 3. Conductors for individual or multiple equipment branch circuits shall have an ampere capacity of not less than 125% of the total connected ampere load served by the branch circuit.
- H. Where specific conductor sizes required by the Drawings are larger than the NEC requires, the larger sizes shall be installed.
- I. Cables shall not be bent, either permanently or temporarily during installation, to radii less than 10 times the outer diameters, except where shorter radii are approved for conditions making the specified radius impractical.
- J. No. 14 AWG wire shall be permitted only for systems control and alarm circuits.
- K. All wiring for the individual specified systems (fire alarm, telephone/data, intercom, paging, etc.) shall be as scheduled on the drawings and/or as described within the appropriate spec Sections.
- L. Refer to Section 260120 for conductor insulation, color coding, connectors, and support requirements.

END OF SECTION 26 00 53

SECTION 26 00 54-CUTTING AND PATCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish materials, tools, labor, and supervision necessary to cut and patch existing construction as required.

1.03 DESCRIPTION

- A. This Section describes the cutting and patching of existing construction required by the installation of new electrical work and for the removal of existing electrical devices and wiring.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide proper materials to match existing construction.

PART 3 EXECUTION

3.01 GENERAL

- A. This Contractor shall provide all holes and channels in existing construction required for concealed installation of electrical wiring and equipment.
- B. Holes and channels shall be cut as small as practical and in a manner satisfactory to the Architect.
- C. This Contractor shall patch and "finish sand" all holes and channels cut for the installation of electrical wiring and electrical equipment and shall patch all damage caused by the installation and/or removal of electrical wiring and equipment.
- D. Finishing (paint, wall covering, etc.) shall not be included under this Section.
- E. Refer to Section 260056 for firestopping requirements.

END OF SECTION 26 00 54

SECTION 26 00 55-TEMPORARY POWER

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide materials, equipment, labor, and supervision necessary to provide temporary lighting and temporary power, whether or not specifically called for on the plans, as required to facilitate completion of the project by all Trades. This section to include but not be limited to the following:
 - 1. Conductors
 - 2. Overcurrent Protection
 - 3. Hangers and Supports
 - 4. Wiring Devices
 - 5. Safety Basketed Fixtures

1.03 STANDARDS AND CODES

- A. Except where otherwise required by this Section, the following standards and codes shall govern:
 - 1. Temporary Wiring: NEC Article 590

PART 2 PRODUCTS

2.01 RELATED EQUIPMENT AND MATERIALS

- A. The equipment and materials to provide temporary 208/120V 3-phase 4-wire feeders and branch circuit panelboards.
- B. The equipment and materials related to temporary lighting.
- C. The equipment and materials related to temporary power and receptacles.

PART 3 EXECUTION

- A. Furnish, install, and remove temporary lighting and power services required by all Trades for the completion of the project.
- B. Provide load centers and GFCI protected receptacles as required by all Trades in full compliance with all OSHA regulations and all applicable codes.
- C. Provide temporary safety basketed lighting throughout all construction areas. Provide 20A1P toggle type switches for group on/off control of all temporary lighting.

END OF SECTION 26 00 55

SECTION 26 00 56-FIRESTOPPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish materials, tools, labor, and supervision necessary to furnish and install fire stopping materials.

1.03 DESCRIPTION

- A. Fire and smoke barriers shall be maintained at all locations where this Section contractor's work requires penetration.
- B. Refer to Specification Section 260111 for installation of boxes in fire-rated walls.
- C. The final installation shall meet requirements of the NEC, specifically paragraph 300.21, and other applicable building codes and regulations.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All products used under this Section shall be UL listed for the purpose.
- B. Penetrations for conduits, cable, cable trays, bus ducts and sleeves shall be sealed with the appropriate intumescent caulk, putty, strip, block, sponge, or sheet type fire barrier product; Hilti "FS-One", Nelson "Flameseal", Specified Technologies Inc. "Spec Seal", International Protective Coatings "Flamesafe", CSD Sealing Systems, or approved equal as manufactured by 3M.
- C. Firestopping materials shall be installed in accordance with all U.L. System requirements for the type of penetration and firestopping system used. The following U.L. System descriptions are those of Hilti Inc. firestopping systems.

PENETRATION	F RATING	U.L. SYSTEM
Metal pipe through gypsum board	1 or 2 hours	Hilti # W-L-1054 or approved equal
Metal pipe through masonry/concrete floor or wall	3 hours	Hilti # C-AJ-1155, #C-AJ-1226 or approved equal
Metal pipe through poured concrete floor slabs	3 hours	Hilti # F-A-1017 or approved equal
Metal pipe through wood floor/ceiling assembly	1 or 2 hours	Hilti # F-C-1059
Plastic pipe through masonry/concrete floor or wall	3 hours	Hilti # C-AJ-2109 or approved equal
Plastic pipe through gypsum wall assembly	1 or 2 hours	Hilti # W-L-2251
Plastic pipe through wood floor/ceiling assembly	1 or 2 hours	Hilti # F-C-2127
Cable through gypsum board	1 or 2 hours	Hilti # W-L-3065 or approved equal
Cable through masonry/concrete floor or wall	3 hours	Hilti # C-AJ-3095 or approved equal
Cable through poured concrete floor slabs	3 hours	Hilti # F-A-3007 or approved equal
Cable/cable bundle through wood floor/ceiling assembly	1 or 2 hours	Hilti # F-C-3012

PENETRATION	F RATING	U.L. SYSTEM
Cable tray through gypsum board	1 or 2 hours	Hilti # W-L-4011, # W-L-4019 or approved equal
Cable tray through masonry/concrete floor or wall	3 hours	Hilti # C-AJ-4035 or approved equal
Cable tray through gypsum wall assembly	1 or 2 hours	Hilti # W-L-4011
Multiple cable trays through masonry/concrete floor or wall	3 hours	Hilti # C-AJ-4017 or approved equal

PART 3 EXECUTION

- A. This Section Contractor shall install the firestopping materials as described per the manufacturer's instructions.
- B. The Contractor shall show proof of compliance by providing the appropriate UL firestopping system number to the inspection authority having jurisdiction.

END OF SECTION 26 00 56

SECTION 26 00 60-EXCAVATING, TRENCHING, BACKFILLING AND RESTORATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish materials, tools, labor, and supervision necessary to provide all excavating, trenching and backfilling required for the proper installation of electrical equipment and wiring.
- B. Exact routing of trenching shall be determined by the Electrical Contractor and approved, in advance, by the Construction Manager and the Architect.

PART 2 EXECUTION

2.01 EXISTING UNDERGROUND FACILITIES

- A. Drawings indicate the approximate desired position of equipment and routing of ducts, pipe and conduits. If field conditions are encountered which make arrangements indicated impossible or impractical, submit request for deviation in writing to the engineer, with drawings where required to clarify the request. Do not proceed until the request has been accepted in writing.
- B. Investigating, locating, marking and protecting existing underground facilities, public and private, shall be the responsibility of the Electrical Contractor.
- C. The Electrical Contractor shall notify the Ohio Utilities Protection Service (OUPS) at 800-362-2764, and owners of utility facilities who are not members of OUPS, at least 48 hours prior to construction.
- D. Any damage to underground facilities caused by the Electrical Contractor shall be repaired at no cost to the Owner.
- E. Clearances of underground facilities shall be as follows:
 - 1. Maintain minimum clearances of 12" vertical and 36" horizontal between proposed underground facilities and new and/or existing water lines.
 - 2. Maintain minimum clearances of 18" vertical and 18" horizontal between proposed underground facilities and new and/or existing sanitary sewer lines.
 - 3. Maintain minimum clearances of 12" vertical and 12" horizontal between proposed and existing underground facilities not listed above.

2.02 OPEN TRENCHING

- A. The Electrical Contractor shall perform all excavating and trenching required for light pole bases, underground wiring, conduit, and duct banks.
 - 1. Trenches shall be opened in straight lines and bottomed out at least 4" below conduits or ducts. Minimum depth as indicated shall be maintained between top of largest conduit or duct and finish grade.
 - 2. Heavy steel plating shall be installed across all trenches where they traverse roadways, drives, and lot aisles to maintain existing traffic patterns throughout the construction period.
 - 3. Care shall be taken in excavating that walls and footings and adjacent load bearing soils are not disturbed in any way. Where a line must pass under a footing, the crossing shall be made by the smallest possible trench to accommodate the duct or conduit.
 - 4. Excavations shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of conduit laying or duct installation, than that which is authorized or directed by the Construction Manager and/or the Architect.

5. Existing excavated concrete and asphalt shall be removed from the job site by the contractor.
6. Sub-base material, where suitable, shall be permitted to be used for backfilling. Unsuitable or surplus material shall be removed from the jobsite by the contractor.
7. Contractor shall cut any interfering trees, remove all stumps, rocks, etc. in the line of the excavation. Approval of the Architect must be obtained before any tree is removed.
8. Any shrubbery in line of excavation shall be removed with a ball of dirt and replaced at completion of excavation.
9. Roots shall be removed to a level of eighteen (18) inches below finished grades and deeper as required for duct runs, manholes, and light pole bases. No roots shall be allowed to remain under the work.

2.03 BACKFILLING AND RESTORATION

- A. The Electrical Contractor shall perform all backfilling associated with the above described excavation work.
 1. Backfill all trenches and excavations using suitable excavated materials as defined in ODOT 203 unless specifically noted otherwise on the Drawings.
 2. Backfilling shall commence immediately after work has been inspected and shall progress as rapidly as the testing and acceptance of the finished sections of the work will permit.
 3. Backfill about the structures shall be placed, when practical, as the work of construction progresses. Backfilling on or against concrete work shall commence only when directed.
 4. Prior to backfilling the trench, conduits shall either be backfilled and compacted, or encased using one of the following methods, as required per the Drawings.
 - a. Place fine aggregate consisting of natural sand or #8 granular material (3/8" diameter or less), as defined in ODOT 703, around raceways and compact material firmly around conduits to a depth of not less than four (4) inches over the top of the duct.

- b. In lieu of fine aggregate, the contractor may provide nonmetallic ties to prevent floating of conduits and encasement using low strength mortar backfill, as defined in ODOT 613, consisting of a flowable concrete mix. The concrete mix shall have a compressive strength between 50 and 100 psi at 28 days, which will allow future excavation.
 - c. Where duct banks are indicated to be concrete encased, provide nonmetallic ties to prevent floating of conduits, use care in placing concrete to not damage or dislocate raceways, and liberally and continuously hand spade to insure there are not voids between and under conduits. Concrete shall be Class C, as defined in ODOT 499, with an average compressive strength of 4,000 psi at 28 days. Mechanical vibrators are not acceptable.
 - 5. Trench backfilling and backfill around structures shall be compacted thoroughly in layers and shall be brought up to within six (6) inches of finished grades.
 - a. Backfill under roadways, drives, and parking areas shall be bank run gravel or approved granular material (ie, sand) and shall be installed in 6" layers, and tamped after each layer.
 - b. Backfill under building walls, and/or footers shall be concrete of the same strength as walls of footers.
 - c. Backfill in grassy areas shall be clean and free from vegetative matter, sticks, rocks and refuse.
- B. All restoration work shall be performed by the Electrical Contractor in full compliance with all City regulations (where applicable), and Architect's directives.
- 1. Concrete areas shall be replaced to match.
 - 2. Concrete walks shall be removed in full sections and replaced to match.
 - a. Sidewalks shall be 5" thick with 6" by 6" by 10/10 gauge welded wire reinforcement, cross slope, and textured finish.
 - b. Control joints shall be 8'-0" on center and expansion joints shall be as recommended per American Concrete Institute Standards.
 - 3. Asphalt areas shall be replaced with 5" minimum ODOT 441 asphalt concrete surface.
 - a. Construction shall be 2" minimum Type 1 asphalt concrete wearing surface with 3" minimum Type 2 asphalt concrete intermediate surface and 6" minimum ODOT 301 crushed aggregate base.
 - b. Finished asphalt surface to be graded such as to avoid "ponding" of surface rain water.
 - 4. Grassy areas shall be finished with 6" best grade topsoil that is free of all rocks and debris, compacted in layers and carried to a crown of approximately 6" above finished grade. Rake to remove all stones, heavily seed (fairlawn mix), and install 3" thick cover of straw and bio-degradable green netting that is anchored on all sides on 36" centers.
- C. Shrubbery removed during excavation shall be replanted using backfill mix as defined in ODOT 661. Where shrubbery is indicated to be maintained, but does not survive construction or fails to establish after replanting, it shall be replaced.

END OF SECTION 26 00 60

SECTION 26 00 74-ELECTRICAL DEMOLITION AND SALVAGE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. In areas that are to be remodeled, provide labor, materials, equipment and supervision necessary to schedule and complete all work associated with the demolition and salvage of electrical equipment and wiring.
- B. The Electrical Contractor shall provide protection for all adjacent areas before, during and following demolition operations.
- C. Where remodeling of existing work is required, these specifications make no attempt to define exact extent of work involved, except to establish minimum standards for workmanship and materials. In general, make extensions to existing work with materials matching similar work remaining.

PART 2 EXECUTION

2.01 DEMOLITION WORK - SERVICES

- A. Active Services: When encountered, support active electrical services as necessary. If active services require relocation (other than those indicated on the drawings), obtain written instructions before proceeding. Do not disturb active services scheduled to remain.
- B. Inactive Services: When encountered, remove conduit and wire full length. Notify servicing utility when encountered outside of structure.
- C. Interruption of Service: When work progress makes temporary shutdown unavoidable, shutdown shall be at night or at such time as approved by Owner so as to cause minimum disruption to established operating routine. Arrange to work continuously, including overtime as necessary to re-establish service within shortest possible down time. In those instances where the length of time required for the service interruption is not acceptable to the Owner, furnish and install temporary wiring as required to reduce the length of time of service interruption to an acceptable level.
- D. In areas where new construction ties into existing work or in remodeled areas, dismantle the existing electrical facilities as necessary. Relocate any existing services interfering with construction.

2.02 DEMOLITION WORK - GENERAL

- A. Remove all existing electrical devices and wiring in remodeled areas that interfere with new construction and are not necessary to maintain service to equipment and devices that are to remain.
- B. Relocate, and/or extend as required, wiring that interferes with new construction and is essential to maintain service to equipment and devices that are to remain.
- C. Remove and/or relocate those devices specifically indicated on the drawings and as required to complete demolition work.
- D. In those cases where devices are removed, the associated wiring that will no longer be active shall be removed.
- E. All wiring and feeders to be removed shall be removed full length back to the source. Identify all abandoned feeder breakers as spare.
- F. All holes or damage caused by the removal of existing work shall be properly patched. Holes shall be neatly patched with suitable materials to match existing surfaces. Conduits that penetrate the ground floor slab shall be cut flush with slab, filed to remove burrs, and grouted to match floor.

G. Furnish and install blank coverplates over all abandoned outlet boxes.

2.03 SAFE DISPOSAL OF BALLASTS AND LAMPS

- A. Electrical Contractor shall safely dispose of all fluorescent and HID ballasts and lamps in full compliance with all Federal and State of Ohio EPA regulations.
- B. Electrical Contractor shall; under the base bid proposal; package, dispose, and/or recycle all lamps and ballasts removed under the demolition portion of this contract.
 - 1. Disposal shall be completed at an EPA approved hazardous waste facility.
 - 2. Recycling shall be completed by an EPA approved recycle facility.
- C. Electrical Contractor shall provide both Owner and Architect with copies of all lamp and ballast disposal/recycle documentation in accordance with US EPA and State EPA regulations.

2.04 SALVAGE

- A. All electrical material and devices that are removed shall be stored on the site for salvage by the Owner. All items not selected for salvage shall become the property of the Electrical Contractor and shall be removed from the site by the Electrical Contractor.

PART 3 EXECUTION - (NOT USED)

END OF SECTION 26 00 74

SECTION 26 01 11-CONDUIT SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish materials, tools, labor, and supervision necessary to fabricate and install complete conduit systems.
- B. Conduit systems shall be provided for all wiring, except where the Drawings or other specification sections indicate that wiring is permitted to be installed without conduit.

1.03 STANDARDS AND CODES

- A. Methods of fabrication and installation shall comply with the provisions of applicable Section NEC, Article 300.
- B. Materials shall be UL and NEC approved for the application intended.

1.04 DESCRIPTION

- A. This Section describes the basic materials and methods of installation for circular cross section conduit systems. Other types of conduit or raceways when required shall be as specified in other Sections, or as called for on the Drawings.

1.05 QUALIFICATIONS

- A. The materials used in the fabrication of the conduit system shall be products of a manufacturer regularly engaged in the manufacturing of the specified material. Where a manufacturer is named for a particular material, the material of other manufacturers shall be acceptable provided the material meets requirements of the specification.

PART 2 PRODUCTS

2.01 CONDUIT

- A. Coated Rigid Conduit: Full weight, threaded, rigid steel, 40 mil PVC coated on outside, 2 mil urethane coated on inside conduit. Approved sources for this raceway are Robroy "Plastibond-Red" (Westwood Electrical Sales, 440-835-9960), Ocal, Inc "Ocal-Blue" (Greisser Sales, 216-771-6120), or Calpipe Industries "Calbond" (Fields Electrical Sales, 513-228-1010). All associated raceway fittings, sweeps, etc., shall be coated. Field cut raceways shall be touched up with matching finish. Use for all conduit, regardless of size, where installed in earth fill, or where specifically required by the drawings.
- B. Rigid Conduit - Steel: Full weight, threaded, rigid steel conduit, galvanized inside and out by hot dip or electro galvanizing process with electrostatically applied baked coating. Use for all conduit, regardless of size, where installed in poured concrete walls, columns, floors or other concrete slabs or where specifically required by the drawings.
- C. Rigid Conduit - Aluminum: Full weight, threaded, rigid aluminum conduit may be used for all conduit, regardless of size, where installed exposed outdoors on roofs or in damp/wet locations or where specifically required by the drawings. Expansion fittings and supports shall be utilized to absorb and prevent deflections due to thermal expansion.
- D. Electrical Metallic Tubing: Thinwall, electrically welded cold rolled steel conduit, galvanized inside and out by electro galvanized process. Baked clear elastic enamel coating. Use indoors for conduit sizes through 4", where installed concealed in walls and above suspended ceilings and where exposed.
- E. Flexible Metal Conduit: Formed of one continuous length of spirally wound electro galvanized steel strip. Use for final connections to equipment such as unit heaters, fans, air handling units, pumps, dry type transformers, and for wiring within casework and millwork. Aluminum flexible conduit may be used for connections from junction boxes to lighting fixtures.

- F. Liquid-tight Flexible Metal Conduit: Formed of one continuous length of spirally wound steel strip, with water and oil tight neoprene jacket. Use for final connections to equipment listed in paragraph D above when located in wet or damp areas.
- G. PVC Conduit: Schedule 40 heavy wall rigid, rated for 90°C cable, composed of polyvinyl chloride and shall conform to NEMA Standards. Conduit, fittings, and pipe-joining materials shall be produced by the same manufacturer. At Contractor's option and where permitted by NEC and local jurisdiction, PVC conduit may be used where buried outside building, or encased in concrete, or in/below floor slabs. Electrical Contractor shall be responsible for upsizing raceway if necessary as required by NEC.
- H. Intermediate Metal Conduit (IMC): May be used as approved by the NEC for 2" and larger where rigid conduit is specified. IMC shall not be used for conduit buried in earth fill.
- I. Fibrous nonmetallic tubing (loom), non-metallic sheathed cable, and metal-clad cable shall not be used.

2.02 CONDUIT FITTINGS

- A. Rigid Conduit Fittings: Threaded, galvanized malleable iron or heavy steel, water and concrete tight.
- B. Metallic Tubing Fittings: Set screw type galvanized steel, concrete tight. Die cast type indentor type fittings will not be allowed.
- C. Flexible Metal Conduit Fittings: Squeeze or screw type galvanized malleable iron or steel with nylon insulated throats, or steel with set screws.
- D. Liquid-tight Flexible Metal Conduit: Galvanized malleable iron or steel, with watertight gaskets, "O" ring and retainer, and nylon insulated throats.
- E. Condulet Fittings: Exposed conduit fittings shall be condulet type for sharp turns, tees, etc. Condulet covers shall be gasketed where exposed to moisture.
- F. Threaded conduit terminations for weatherproof applications shall be made by use of Myers Hubs.

2.03 OUTLET BOXES

- A. Material, size and installation for outlet boxes shall comply with NEC Article 314.
- B. Boxes shall be Raco, Steel City, Appleton or equivalent, catalog numbers listed below are based on Raco, unless otherwise indicated. In general the type of boxes shall be as follows:
 1. In stud walls: For single outlet use 4" square by 2-1/8" deep box No. 232 or 233. For ganged outlets use 4-1/2" high by 1-13/16" deep multiple gang boxes No. 951 through No. 958. Boxes to be provided with raised adapters of depth as required for thickness of wall materials.
 2. In masonry and poured concrete walls: For single outlets requiring two conduit connections in top and/or bottom of box use 4" square by 2-1/8" deep box No. 232 or 233 with raised square cut adapter. For ganged outlets use 3-3/4" high by 2-1/2" deep multiple gang masonry boxes No. 691 through No. 694 and No. 960 through No. 964.
 3. Surface mounted wall outlets: For single outlet use 2-1/8" deep handy box No. 674, for two outlets use 4" square by 2-1/8" deep box No. 232 or 233. For more than two ganged outlets use 3-3/4" by 2-1/2" deep multiple gang masonry boxes No. 692 through No. 694 and No. 960 through No. 964. Boxes to be provided with 1/2" raised cover as required for device.
 4. In suspended ceilings: Use 3-1/2" deep octagon box No. 280 or No. 281 with fixture studs and steel mounting bars.
 5. In poured concrete ceiling slabs: Use octagon concrete rings with back plates.

6. Where outlet boxes are free standing on conduit stubs in kitchens, laundries, shops and other areas indicated, use Crouse-Hinds Type FS or FD malleable iron cadmium finish boxes with appropriate gasketed cover plate to suit device.
7. Outlets installed outdoors or in wet locations: Use Crouse-Hinds Type FS or FD box with NEMA 3R coverplates listed for "raintight while in use" for receptacles. Covers for switches shall be Crouse Hinds No. DS185. Diecast "bell" type boxes are not acceptable.
8. Floor outlets in above grade concrete slabs: Use concrete tight stamped steel galvanized box with fully adjustable top, Hubbell No. B-2527 for greater than 3" fill, No. B-2529 for 2" to 3" fill. Floor outlets in concrete slabs on grade: Use watertight cast iron box with fully adjustable top, Hubbell No. B-2536 for greater than 3" fill, No. B-2537 for 2" to 3" fill. Furnish for each outlet a No. S-2525 cover. Service fittings shall be as described on the Drawings. Furnish for each outlet in carpeted floor a No. S-3082 carpet flange.

2.04 PULL AND JUNCTION BOXES

- A. Construction, size and installation of pull and junction boxes shall comply with NEC, Article 314.
- B. Pull and junction boxes shall be fabricated of heavy gauge galvanized steel with screw covers, brass screws and hardware with enamel finish.
- C. Pull and junction boxes for installation in poured concrete floors shall be flush type, cast iron, with watertight gasketed covers. Boxes for installation in floors with tile or carpet floor covering shall have recessed covers to accommodate the floor covering.
- D. Pull and junction boxes for above grade outdoor installations shall be rain-tight.
- E. Grade level junction boxes shall be manufactured by Synertech or CDR Systems Corporation with open flared bottom and cover. Logo on cover to read "ELECTRIC", etc. Enclosures and covers shall be concrete gray color and rated for no less than 5,000 pounds over a 10" x 10" area and be designed and tested to temperatures of -50 degrees F. Material compressive strength should be no less than 11,000 psi. Covers shall be secured with two pentahead stainless steel bolts. Bolts shall be retained in lid when unscrewed. Bolts shall be secured to replaceable threaded inserts with openings at base to allow debris to fall through and thereby avoiding clogged threaded inserts.

2.05 AUXILIARY GUTTERS

- A. Construction, sizes and installation of auxiliary gutters shall comply with NEC, Article 366.

2.06 HANGERS AND SUPPORTS

- A. Provide conduit hanger and support devices of approved type for required methods of support to include: structural steel members, suspension rods, conduit clamps, concrete inserts, expansion shields, beam clamps and welding pins. All devices shall have galvanized finish or other approved corrosion resistive finish. In general, hangers and supports shall be as follows:
 1. Where a multiple run of conduit is routed on surface of structure, use conduit clamps mounted on Unistrut or equal channel so as to maintain clearance between conduit and structure.
 2. Where single run of conduit is suspended from overhead; use split ring conduit clamp suspended by steel drop rod.
 3. Where multiple parallel runs of conduit are suspended from overhead; use split ring conduit clamps uniformly spaced and supported on trapeze hangers fabricated of Unistrut Channels, suspended by not less than 1/2" continuously threaded steel drop rods.
 4. Where conduit is buried in concrete floor slabs; anchor conduit to structural floor with conduit clamps, at 10'-0" (maximum) intervals.
 5. Any form of strap iron or wire hangers will not be accepted.

6. Maximum hanger and support spacing shall be in accordance with NEC Sections 342.30 (IMC), 344.30 (GRC), and 358.30 (EMT). Regardless of listed spacing provide additional hangers or supports at not more than 2'-0" from each change of direction and at each side of any box or fitting.
- B. Hangers and supports shall be anchored to structure as follows:
1. Hangers and supports anchored to poured concrete: Use malleable iron or steel concrete inserts attached to concrete forms.
 2. Hangers or supports anchored to precast concrete: Use self-drilling expansion shields. Expansion shields may also be used where concrete inserts have been missed or additional support is required in poured concrete.
 3. Hangers or supports anchored to structural steel: Use beam clamps and/or steel channels as required by structural system.
 4. Hangers or supports anchored to metal deck: Use spring clips or approved welding pins. Maximum permissible load on each hanger shall not exceed 50 pounds.
 5. The use of explosive force hammer actuated, booster assist or similar anchoring device will not be permitted without prior approval of the Architect.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

- A. In general, horizontal runs of conduit shall be installed in ceiling plenum. Conduit for convenience outlets, wall mounted fixtures and other wall outlets shall be routed overhead and concealed in wall to the outlet. Conduit shall not be installed in concrete floor slabs except where conditions will not permit the conduit to be routed overhead.
- B. Generally, conduit shall be concealed, except in crawl spaces, tunnels, shafts, mechanical equipment rooms, and at connections to surface panels and free-standing equipment, and as otherwise noted on Drawings. No surface raceways shall be used on the floor.
- C. Exposed conduit shall be routed in lines parallel to building construction lines. Exposed conduit locations shall be approved by the Architect prior to installation.
- D. No conduit shall be installed less than 6" from piping installed by other trades. Conduits shall be located to avoid ductwork, piping and other obstructions.
- E. Certain conduits are permitted to be embedded in structural concrete work. Contractor shall cooperate with other Contractors of their respective trades to effect the following:
 1. Reinforcing steel shall be securely anchored in place before installing conduit.
 2. No steel reinforcing shall be displaced from plan dimensions without approval of Architect.
 3. Conduit shall not be placed over top of reinforcing or under bottom of reinforcing, where crossing beams.
 4. Conduit and fittings shall not displace concrete in columns in excess of 4% of total cross-section area of column without approval of Architect.
 5. Conduit shall not be placed closer than 3 diameters on center.
 6. Maximum size of embedded conduit or pipe shall not exceed 1/3 thickness of structural slab; 2/3 thickness of topping slab.
- F. Minimum size conduit shall be 1/2" trade size. Where specific size is not called for on Drawings or in the specification, Contractor shall select size required from Chapter 9 of NEC. Where specific sizes required by Drawings or Specifications are larger than Code requires, the larger size shall be installed.

- G. Install the conduit system mechanically and electrically continuous from outlet to outlet and to cabinets, junction or pull boxes. Conduit shall enter and be secured to cabinets and boxes in such a manner that all parts of the system will have electrical continuity. Feeder raceways shall terminate in cabinets and pull boxes with double locknuts and insulating bushings.
- H. Metal conduit buried in earth fill shall be protected with an approved corrosion resistant material.
- I. Conduits shall be capped during construction to prevent the entrance of foreign materials and moisture.
- J. Where conduits cross building expansion joints, O-Z Gedney Company type "DX" conduit expansion fittings complete with bonding jumpers shall be used.
- K. Contractor shall cut and patch existing construction for conduit installation as required.

3.02 OUTLET BOX INSTALLATION

- A. Outlet boxes shall be installed for fixtures, switches, receptacles and other devices.
- B. Approximate location of outlets are shown on the plans, but each outlet location shall be verified by the Contractor before installing the outlet box.
- C. Openings for electrical boxes in fire-rated walls that do not exceed 16 square inches in area are permitted in fire-rated construction provided that the aggregate area of such openings does not exceed 100 square inches for any 100 square feet of wall area.
- D. Where service utility boxes greater than 16 square inches exist in fire-rated wall construction, if the opening is not otherwise detailed to maintain the fire-rated integrity of the wall, provide firestopping wrap to the back side of each utility box.
- E. Outlet boxes on opposite sides of fire-rated walls shall be separated by a horizontal distance of not less than 24 inches.
- F. Outlet boxes installed flush in a common wall shall not be back-to-back or through-wall type, unless construction requires same. Where it is necessary to install boxes back-to-back, install sound absorption material between boxes and seal the conduit nipple between boxes with duct seal.
- G. Boxes located on opposite sides of a common wall that are connected by 12" conduit length or less, shall have the conduit openings plugged with duct seal at both ends.
- H. Outlet boxes shall be installed plumb and square with wall face and with front of box or cover located within 1/8" of face of finish wall. Boxes in masonry shall be set with bottom of the box tight to the masonry unit.

3.03 PULL AND JUNCTION BOX AND GUTTER INSTALLATION

- A. Install pull boxes, junction boxes and auxiliary wiring gutters where indicated on Drawings and where required to facilitate installation of the wiring.
- B. For concealed conduit, install boxes flush with ceiling or wall, with covers accessible and easily removable. Where flush boxes are installed in finished ceilings or walls, provide cover which shall exceed the box face dimensions by a sufficient amount to allow no gap between box and finished material.
- C. Boxes shall not be exposed in finished, occupied rooms, without prior approval of Architect.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Hangers and supports shall be installed for all conduit and boxes.
- B. Conduit and boxes shall not be attached to or supported from mechanical pipes, plumbing pipes or sheet metal ducts.
- C. Conduits routed in lay-in grid ceiling plenum shall not be supported from the ceiling hanger iron or ceiling tees.

END OF SECTION 26 01 11

SECTION 26 01 20-Wire and Cable

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish material, tools, labor, and supervision necessary to install wire and cable.

1.03 STANDARDS AND CODES

- A. Methods of installation shall comply with the provisions of applicable sections of NEC, Article 300.
- B. Materials shall be in accordance with NEC, Article 310 and shall be UL listed for application intended.

1.04 DESCRIPTION

- A. This section describes the basic materials and methods of installation for general wiring systems of 600 volts and less. Wiring for a higher voltage rating, if required, shall be as specified in other sections or as called for on the drawings.
- B. Minimum size conductors shall be No. 12 AWG for power and lighting and No. 14 AWG for signal and control.
- C. Refer to Spec Section 260053 for specific instructions with respect to sizing and installation of feeder and branch circuit conductors.

1.05 QUALIFICATIONS

- A. The material used for the wiring systems shall be the products of a manufacturer regularly engaged in the manufacturing of the specified material. Where a manufacturer is named for a particular material, the material of other manufacturers will be acceptable provided the material meets requirements of the Specifications.

PART 2 PRODUCTS

2.01 WIRE AND CABLE

- A. Wire and cable for power, lighting, control and signal circuits shall have copper conductors of not less than 98% conductivity and shall be insulated to 600V. Conductors shall be stranded except where specifically noted otherwise.
- B. Wire and cable type for the various applications shall be as follows:
 - 1. Type THWN or XHHW (75°C): Use for branch circuits, panel and equipment feeders in wet and dry locations.
 - 2. Type THHN or XHHW (90°C): Use for branch circuits, panel and equipment feeders in dry locations only. Use where lighting branch circuit conductors are routed through fluorescent fixture channels.
 - 3. Type "VFD Rated": Feeders, size #8 AWG and larger, from variable frequency drives shall be multi-conductor shielded cables with the following performance requirements.
 - a. Phase conductors shall be tinned copper, extra flexible 34 AWG Class M stranding (size 10 AWG and smaller) or 30 AWG Class K stranding (size 8 AWG and larger), with XLPE insulation.
 - b. Ground conductors shall be tinned copper, 100% rated, and symmetrically spaced (three ground cables total).
 - c. Shielding shall consist of 100% aluminum foil shield with 85% tinned copper braided shield (size 2 AWG and smaller) or two (2) copper tape shields with 100% coverage (size 1 AWG and larger).

- d. Overall cable jacket shall be type TPE, sunlight and oil resistant, and have a tray cable exposed rating, Type TC-ER.
- 4. Type UF: Use where permitted by other Sections or by the drawings for underground direct burial branch circuits.
- 5. Type AF or SF-2 silicone rubber with heat-resistant glass braid (rated minimum 150°C) shall be used for branch circuit conductors connecting to fixture conductors within the fixture housing or to a connection box attached to the fixture and subject to temperatures equal to the temperatures within the fixture housing.

2.02 CONDUCTOR COLOR CODING AND IDENTIFICATION

- A. Wiring systems shall be color coded. Conductor insulation shall be factory colored in sizes up through No. 8 AWG. Conductors No. 6 AWG and larger shall have black insulation and shall be phase color coded with one half inch band of colored tape at all junctions and terminations. Colors shall be assigned to each conductor as described below and carried throughout all main and branch circuit distribution.

	<u>208/120 Volt</u>	<u>480/277 Volt</u>
Phase 'A'	Black	Brown
Phase 'B'	Red	Orange
Phase 'C'	Blue	Yellow
Neutral	White	Gray
Equipment Ground	Green	Green
Isolated Equipment Grounding	Green w/ Yellow Stripe	

- B. Contractor shall take extraordinary care to ensure that phase and bus orientation in each and every panel is identical.
- C. Control wiring shall be color coded such that red is used exclusively for all 120 volt conductors and white for all neutral conductors. All control wiring to be identified at both ends with permanent wire markers.

2.03 CONNECTORS

- A. Splices and junctions for conductors #8 AWG and smaller shall be 600V rated with "live spring" and insulated rigid nylon wing style body, 3M "Performance Plus", Ideal "Buchanan B-Cap", or equal.
- B. In-line connectors for 600V copper conductors #6 AWG thru #3 AWG shall be ILSCO type "CT" circumferential compression sleeves or equal by 3M, Burndy, or Thomas & Betts.
- C. In-line connectors for 600V copper conductors #2 AWG and larger shall be extra long barrel dual-crimp ILSCO type "CTL" compression sleeves or equal by 3M, Burndy, or Thomas & Betts.
- D. Insulate in-line connectors with cold shrink silicone insulators 3M "8440" series.
- E. Taps for copper conductor 600V or less, sizes No. #6 AWG and larger shall be ILSCO "AH" series or equal by 3M, Burndy, or Thomas & Betts.
- F. Insulate taps to thickness of conductor insulation with half-lapped layers of 3M "Scotch" brand No. 33 vinyl electrical tape. Connectors having irregular surfaces; fill voids and smooth contours with 3M "Scotchfil" electrical putty prior to taping.
- G. Where mechanical style connections are permitted, cable terminations to bus bars and switch pads shall be ILSCO "TA" two-hole mechanical or equal by 3M, Burndy, or Thomas & Betts.
- H. Where compression style connections are required, cable terminations to bus bars and switch pads shall be ILSCO "CLWD" two-hole long-barrel dual-crimp compression type with sight hole or equal by 3M, Burndy, or Thomas & Betts.

1. Lugs installed in wet locations on poles or outdoors where exposed shall be furnished without sight hole, ILSCO "CLND" or equal by 3M, Burndy, or Thomas & Betts.
 - I. Mechanical and compression termination bolt/stud size and mounting hole spacing shall match factory bus hole size. Stacking lugs and spacers shall be provided as required for parallel cable runs.
 - J. Cable terminations at motors shall be bolted and removable with 1-hole copper compression lugs on the motor pigtail and feeder conductors, and motor terminal insulation kit 3M "5300" series, or equal. Motor terminal insulation kit shall include lug cover, mastic strip Scotch No. 2230, silicone grease, and Scotch No. 33 tape.

PART 3 EXECUTION

3.01 PREPARATION

- A. For new construction, wiring shall not be installed in the conduit system until the building is enclosed and masonry work is completed.
- B. Conduit shall be swabbed free of moisture and debris prior to pulling in the conductors.

3.02 CONDUCTOR INSTALLATION

- A. Feeder conductors shall be routed continuous from origin to destination, without splicing, unless specifically noted otherwise on the drawings.
- B. Power feeder conductors shall be pulled with the use of an approved pulling compound or powder, and per the requirements of Section 260125.
- C. Conductor splices shall be made only in readily accessible junction boxes.
- D. Cable supports and boxes shall be installed in all vertical feeders required by Article 300.19 of the National Electrical Code. Cables shall be supported at the top of the vertical raceway plus an additional support for each interval of spacing as specified in table 300.19 (A) of the NEC. For cables without a metallic sheath, the cable support shall be of the split wedge type which clamps each individual conductor firmly and tightens due to weight of cables.
- E. "VFD Rated" multi-conductor shielded cables shall be terminated according to the manufacturers recommendations. Braided shields shall be routed unbroken where service disconnects are located between the VFD and motor. Phase and ground conductors shall be pulled through braided shields at each end and terminated together with the ground conductors.

3.03 CONDUCTOR TERMINATIONS

- A. Terminations materials shall be as required by the equipment manufacturer's installation guidelines.
- B. Bolt diameter shall be properly sized for the terminations, in the absence of manufacturer's installation requirements, the largest diameter shall be used.
- C. Bolts shall be tightened to the torque values specific to the material, threads per inch, and nominal diameter. Bolted connections shall not be lubricated.
- D. Unless stipulated otherwise, the minimum grade bolt material shall be SAE J429 Grade 5 medium carbon steel.
- E. Belleville spring type washers shall be utilized for termination of conductors 350MCM and larger. Split ring lock washers shall be utilized on smaller conductor terminations.
- F. Connections shall be initialed or otherwise labeled after final torqueing.

END OF SECTION 26 01 20

SECTION 26 01 25-PULLING CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide material, equipment, labor, and supervision as required for the complete installation of wire and cable in raceways.

1.03 CODES AND STANDARDS

- A. Methods of installation shall comply with the provisions of applicable sections of NEC Article 300.

PART 2 PRODUCTS

2.01 Products shall be used as described under Part 3.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Suitable installation equipment shall be provided to prevent conductor and raceway damage during the installation of feeders. Ropes used for pulling of feeders in metallic raceways shall be made of polyethylene or other suitable non-metallic material. Metallic ropes shall not be used.
- B. Cable installation in PVC or similar non-metallic raceways or innerducts require the use of woven pull tapes. Tapes shall be Fibertek or equal.
- C. A #14 galvanized steel fish wire or a plastic line having a tensile strength of not less than 200 pounds shall be installed in each conduit, except underground conduits, in which installation of conductors is not included in this section of the Specification. A #10 AWG bare, hard drawn copper shall be installed in each underground conduit or duct, in which installation of conductors is not included in this section of the Specification. Woven tape with embedded copper conductor may be used in lieu of #10 bare. Fibertek "Tracertape" or approved equal.
- D. Fish wires and lines shall be free from splices and shall have ample exposed length at each end.
- E. Wire pulling lubricants, if used, shall conform to UL requirements applicable to the several insulation and raceway materials.
- F. Cables shall not be bent, either permanently or temporarily during installation, to radii less than 10 times the outer diameters, except where shorter radii are approved for conditions making the specified radius impractical.
- G. Pulling lines shall be attached to conductor cables by means of either woven basket grips or pulling eyes attached directly to the conductors. Rope hitches shall not be used. All cables to be installed in a single conduit shall be pulled in together. Where polyethylene insulation is used and a pulling lubricant is required, the lubricant shall be certified by the manufacturer to be non-injurious to polyethylene insulation.
- H. Refer to Section 260120 for cable supports and boxes required for installation of all vertical feeders.

END OF SECTION 26 01 25

SECTION 26 01 40-WIRING DEVICES AND PLATES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide materials, equipment, labor, and supervision necessary to install wiring devices as required by the Drawings and this section.

1.03 STANDARDS AND CODES

- A. Except where otherwise required by this section, the following Standards and Codes shall govern:
 - 1. Receptacles; NEC Article 406
 - 2. Wall Switches; NEC Article 404
 - 3. UL Listed
 - 4. NEMA Standards

1.04 QUALIFICATIONS

- A. Products by Hubbell HBL series, Pass & Seymour - Industrial Spec Grade Series, Leviton - Lev-Spec Series and Eaton-Arrow Hart - Industrial Spec Grade Series are acceptable.

1.05 SUBMITTALS

- A. Prior to the purchase of wiring devices and plates, submit shop Drawings for approval per the requirements of Section 26 00 51.

PART 2 PRODUCTS

2.01 GENERAL

- A. All wiring devices shall minimally be "Industrial Specification Grade" except where higher grade is required by the Drawings.
- B. Wiring devices shall be white in color, unless specifically noted otherwise in the symbol schedule on the Drawings.

2.02 SWITCHES

- A. Wall switches shall be as described in the Symbol Schedule on the Drawings and be UL20 Listed.
- B. Switches shall contain a 1-piece plated steel bridge.
- C. Plug tail devices are listed underlined in table below for each device where available. Acceptable manufacturers and product lines are as follows:

Toggle Switches	Eaton - Arrow Hart	Hubbell	Leviton		Pass & Seymour
20A1P	AH1221	HBL1221 or <u>SNAP 1221</u>	1221 or <u>M1221</u>		PS20AC1 or <u>PT20AC1</u>
20A 3-way	AH1223	HBL1223 or <u>SNAP 1223</u>	1223 or <u>M1223</u>		PS20AC3 or <u>PT20AC3</u>
20A 4-way	AH1224	HBL1224 or <u>SNAP 1224</u>	1224 or <u>M1224</u>		PS20AC4 or <u>PT20AC4</u>

Toggle Switches	Eaton - Arrow Hart	Hubbell	Leviton		Pass & Seymour
20A Momentary	1995	HBL1556	1257		1251

2.03 RECEPTACLES

- A. Receptacles shall be as described in the Symbol Schedule on the Drawings.
- B. Receptacles shall contain a 1-piece, die stamped (not riveted), brass mounting strap with high-impact, chemical resistant face.
- C. 20A Duplex type "Industrial Grade" receptacles shall be UL498 Listed. Refer to Symbol Schedule on Drawings for complete description.
- D. Ground fault circuit interrupting (GFCI) receptacles shall be a U.L. 943 and U.L. 498 Listed duplex feed-through type with power/failure indicating LED, and test and reset buttons. Refer to Symbol Schedule on Drawings for complete description.
- E. "Tamper Resistant" duplex safety receptacles shall be UL 498 Listed, and shall utilize a mechanical shutter assembly which requires the presence of an object in both right and left hand contacts to energize the device. Refer to Symbol Schedule on Drawings for complete description.
- F. "Weather Resistant" duplex receptacles shall be UL 498 Listed, and have corrosion resistant current carrying metal parts including mounting strap and wire binding screws. Receptacles shall be resistant to cold temperatures, ultraviolet radiation, and accelerated aging due to water infiltration. Refer to Symbol Schedule on Drawings for complete description.
- G. Plug tail devices are listed underlined in table below for each device where available. Acceptable manufacturers and product series are as follows:

Device	Eaton - Arrow Hart	Hubbell	Leviton	Pass & Seymour
20A Duplex Receptacles	5362 or <u>5362M</u>	HBL5362 or <u>SNAP5362</u>	5362 or <u>M5362</u>	PS5362A or <u>PT5362A</u>
20 Amp Tamper Resistant Duplex	TR5362 or <u>5362TRM</u>	HBL5362TR or <u>SNAP5362TR</u>	5362-SG or <u>M5362-SG</u>	TR5362 or <u>PTT5362</u>
20A GFCI Tamper Resistant Duplex Receptacles	TRSGF20	GFRTRST20	G5362	2097TR
20A GFCI Tamper- and Weather- Resistant Duplex Receptacles	TWRSGF20	GFTWRST20 or <u>GFTWRST20SNA</u> <u>P</u>	G5263-WT	2097TRWR

2.04 COVERPLATES

- A. Provide plates for all switches, receptacles, TV outlets, other outlets and blank plates for all unused outlets.
- B. Where two or more devices are set at one point, they shall be covered with a common plate.
- C. Plates for flush mounted devices shall be high-impact smooth nylon, similar to Hubbell "P" series, color to match wiring device.
- D. Plates for devices mounted in surface FS or FD boxes shall be heavy-gauge galvanized stamped steel, Crouse Hinds type DS or Appleton type FSK.
- E. Cover for receptacles in wet locations shall self locking vertical flip covers UL listed "suitable wet locations while in use". Clear polycarbonate type shall be Taymac #MM410C for single gang box and #MM2410C for two gang box or equal by intermatic. Cast aluminum type shall be Thomas Betts #CKMGV for single gang box and #2CKG for two gang box or equal by Hubbell. Refer to Symbol Schedule on drawings for complete description.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install wiring devices as indicated on the Drawings, and as described below.
- B. Switches and receptacles shall be installed and located as follows, unless noted otherwise on Drawings:
 1. Switches: 48" above finished floors.
 2. Receptacles: 18" above finished floors generally; 36" above unfinished floors or 6" above counters and work benches (3" above counter backsplash) in kitchens, shops, mechanical equipment rooms and similar areas unless indicated otherwise.
- C. In masonry walls, switches and receptacle heights shall be adjusted as required so outlets are at nearest mortar joint to specified height.
- D. Where light switches are located adjacent to doors, they shall be installed on "knob" side of door opening, unless indicated otherwise.
- E. Where walls have wainscot finish, switch height shall be adjusted as required so switch is either all in wainscot or all in wall above wainscot.
- F. Prior to roughing-in outlet boxes, Contractor shall verify from general construction drawings door swings, type of wall finishes and locations for counters and work benches.

- G. This section Contractor shall provide material as required to completely install work indicated on the Drawings which is located in mill and casework.

END OF SECTION 26 01 40

SECTION 26 01 51-MOTOR WIRING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide equipment, material, labor, and supervision necessary to install wiring and controls for motor driven equipment.

1.03 DESCRIPTION

- A. Unless otherwise specified, the Electrical Contractor shall mount and align all starters, safety switches, variable frequency drives, and other related electrical equipment whether specified in this or other sections of this specification, except where such items are factory mounted on the driven equipment. The mounting and alignment of motors, starters, control equipment, etc., for elevators, dumbwaiters, and for equipment for which the feeders are terminated in safety switches as hereinafter specified, are included in the sections of this specification in which the motors, etc., are specified.
- B. The Electrical Contractor shall furnish and install power wiring to motor starters and from motor starters to motors. In general, temperature control wiring and other specialized control wiring is not included in this Division. Provide control wiring under this division only where specifically indicated on the drawings.

1.04 CODES AND STANDARDS

- A. Installation shall be in accordance with NEC, Articles 300 and 430.

PART 2 PRODUCTS

2.01 RELATED EQUIPMENT AND MATERIAL

- A. The equipment and material related to the wiring of motors should be as called for on the Drawings and as specified in the following Sections:
 1. Section 26 01 11 - Conduit Systems
 2. Section 26 01 20 - Wire and Cable
 3. Section 26 01 55 - Combination Motor Starters
 4. Section 26 01 70 - Disconnect Switches
 5. Section 26 01 81 - Fuses
 6. Section 26 04 10 - Power Factor Correction
 7. Section 26 04 50 - Grounding

PART 3 EXECUTION

3.01 INSTALLATION

- A. Unless otherwise specified, all wiring to motors, control equipment and related electrical equipment shall be installed in rigid conduit, IMC or EMT, with flexible metal conduit connections or liquid-tight flexible metal conduit connection at the motor terminations. Conduits shall be sized to accommodate motor feeders, grounding conductors, and control wires, whether or not so indicated on Drawings. Wire sizes shall be as shown, or if not shown, as required by the load served and the NEC.
- B. Splices/terminations at motors shall be bolted and removable. Insulate splices in motor terminal boxes with elastic void-filling putty or self-fusing (pad-form) compound followed by half-lapped layers of tape. Tape to a thickness equal to the conductor insulation. Terminating materials shall be Scotchfil and Scotch #23 tape.
- C. Prior to final connections, tests and rotation checks shall be made on each motor.

END OF SECTION 26 01 51

SECTION 26 01 52-WIRING EQUIPMENT FURNISHED UNDER OTHER DIVISIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish materials, tools, labor, and supervision necessary to provide wiring to and connect motors or other electrically served equipment provided under other Divisions.

1.03 STANDARDS AND CODES

- A. Except where otherwise required by this Section, the following Standards and Codes shall govern:
 - 1. Branch Circuits: NEC Articles 210 and 220
 - 2. Feeders: NEC Articles 215 and 220
 - 3. Motor Circuits: NEC Article 430
 - 4. Grounding: NEC Article 250

1.04 DESCRIPTION

- A. This Section outlines the scope of the work required and references other Sections in which the materials required for wiring equipment are described.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Wiring materials shall conform to the requirements of the following Sections:
 - 1. Section 26 01 11 - Conduit Systems
 - 2. Section 26 01 20 - Wire and Cable
 - 3. Section 26 01 40 - Wiring Devices and Plates
 - 4. Section 26 01 51 - Motor Wiring
 - 5. Section 26 01 55 - Combination Motor Starters
 - 6. Section 26 01 65 - Branch Circuit Panelboards

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide supplementary control devices for equipment, in addition to those supplied by the equipment manufacturer only where specifically indicated on the drawings.
- B. Provide power wiring to motor starters and from motor starters to motors. In general, temperature control and other specialized control wiring is not included in this Section. Provide control wiring under this Section only where specifically indicated on the drawings.
- C. Each feeder and branch circuit associated with a two-pole or three-pole protective device shall be provided with a separate green insulated equipment grounding conductor. The required equipment grounding conductor shall be sized as shown on the drawings and shall not be smaller than shown in NEC Table 250.122 and shall be installed in a common conduit with the related phase and/or neutral conductors. In the case of parallel feeders, each raceway shall have a full size green insulated equipment ground conductor.

- D. In general, motor starting equipment will be furnished and installed by the Electrical Contractor. Where motor starting equipment is furnished by the Supplier of the equipment, the Electrical Contractor shall install the starter and install all required power wiring. Provide control wiring only as specifically indicated on the drawings. In general, three phase motors will be equipped with combination magnetic starters and fractional horsepower single phase motors will be equipped with manual motor starters.
- E. Electrical equipment to be connected under this Section shall include, but not be limited to, the following:
 - 1. Heating Equipment
 - 2. Ventilating Equipment
 - 3. Air Conditioning Equipment
 - 4. Plumbing Equipment
 - 5. Food Service Equipment
 - 6. Laboratory Equipment
 - 7. Medical Equipment
 - 8. Elevator Equipment
 - 9. Dumbwaiter Equipment

END OF SECTION 26 01 52

SECTION 26 01 54-FRACTIONAL HORSEPOWER MANUAL MOTOR STARTERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish materials, labor, and supervision necessary to install fractional horsepower motor starters as required by the Drawings and this Section.
- B. These starters shall typically be installed for single phase motors with ratings of less than one-half horsepower.

1.03 CODES AND STANDARDS

- A. Fractional horsepower Starters shall be in accordance with NEMA Standards, sizes and horsepower ratings.

1.04 QUALIFICATIONS

- A. Refer to Specification Section 260051, paragraph 1.10 for acceptable manufacturers.

PART 2 PRODUCTS

2.01 GENERAL

- A. Enclosures shall be of the general purpose type except where Drawings call for other type enclosures.

2.02 STARTERS

- A. Fractional horsepower manual starters shall include the following devices:
 1. Neon pilot light
 2. "Quick-make, quick-break" trip-free toggle mechanism
 3. Handle guard/Lock-off
 4. Melting alloy thermal overload relay

2.03 REMOTELY CONTROLLED SINGLE PHASE STARTERS

- A. Remotely controlled single phase starters shall be rated for 1.0HP maximum and 120-240VAC. Starters shall include the following features:
 1. NEMA 1 enclosure
 2. Hand-Off-Automatic functionality
 3. LED for On/Off/Fault indication
 4. Padlockable in the off position
 5. Solid state adjustable overload protection with manual reset
 6. 12-120VAC/DC or dry contact closure for "Run" command input
 7. Integral current sensing proof of "Run" output contact

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install starters for motors as indicated on the Drawings.
- B. Install laminated (P-Touch type) label or engraved nameplate to indicate load controlled and branch circuit serving the starter.

- C. Prior to purchasing starters, obtain from Owner and other Contractors a schedule of motors that will require starters. Notify Engineer immediately of any discrepancies with the Electrical Drawings.

END OF SECTION 26 01 54

SECTION 26 01 65-BRANCH CIRCUIT PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish equipment, materials, tools, labor, and supervision necessary to install branch circuit panelboards as specified in this Section and as called for on the Drawings.

1.03 STANDARDS AND CODES

- A. Fabrication and installation shall comply with applicable Sections of NEC, Article 408 and NEMA Standards.
- B. All panelboards shall be UL listed, labeled, manufactured and tested in accordance with the latest standards of the following:
 1. UL 50 – Enclosures for Electrical Equipment, Non-Environmental Considerations
 2. UL 67 – Standards for Panelboards

1.04 DESCRIPTION

- A. Panelboards described in this Section shall be dead-front, safety type furnished with bolt-on thermal-magnetic molded case circuit breakers for lighting, receptacle and branch circuit applications. Circuit breakers shall have frame and trip ratings as scheduled on the Drawings.

1.05 QUALIFICATIONS

- A. Refer to Specification Section 260051, paragraph 1.10 for acceptable manufacturers.

1.06 SUBMITTALS

- A. Shop drawings to include fabrication details, lug and bus arrangement, ampere and voltage rating, breaker frame sizes and interrupting ratings.

PART 2 PRODUCTS

2.01 PANELBOARDS

- A. Bussing Assembly and Temperature Rise: Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the Drawings. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector to bus bar not to exceed 50°C rise above ambient. Heat rise test shall be conducted in accordance with Underwriters' Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single phase, three-wire panelboard bussing shall be configured such that any two adjacent single-pole breakers are connected to opposite polarities in such a manner that two-pole breakers can be installed in any location. Three-phase, four-wire bussing shall be configured such that any three adjacent single-pole breakers are individually connected to each of the three different phases in such a manner that two or three-pole breakers can be installed at any location. Current-carrying parts of the bus assembly shall be plated. Main bus ratings shall be as described on the Drawings.
- B. A fully rated copper neutral bus shall be provided where three phase/four-wire or single phase/three-wire services are indicated. The neutral bus shall have conductor landing capacity appropriate for the feeder (and bonding jumper, where appropriate) and phase pole count for the panel.
- C. A copper equipment ground bus shall be provided in each panel. The bus shall have conductor landing capacity appropriate for the feeder (and neutral bonding, where appropriate) and minimum of 50% of the phase pole count for the panel.
- D. Safety Barriers: The panelboard interior assembly shall be dead front type.

E. Cabinets and Fronts:

Panelboard assembly shall be enclosed in a hot zinc dipped galvanized steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets.

Wiring gutters shall be in accordance with UL Standard 67 for panelboards.

Fronts shall include hinged front trims, hinged doors with flush, brushed stainless steel, cylinder tumbler-type locks with catches. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Doors shall be mounted by completely concealed steel hinges. A metal circuit directory frame (welded to interior of breaker access door) and card with a clear plastic covering shall be provided on the inside of the door (glued-on directory frames are not acceptable). The directory shall be typed to identify the load fed by each circuit. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and gray baked enamel finish.

1. All multi-section branch circuit panelboards assemblies shall consist of identically sized enclosures, unless specifically noted otherwise on plans.
 2. Eaton hinged front trims for ALL applications shall be "LTDD Series Hinged Front Cover" (EZ-Trim is not acceptable).
 3. ABB (General Electric) hinged front trims shall be "Front Hinged to Box".
 4. Square D hinged front trims shall be "Hinged Front with Hinged Door"
 5. Siemens hinged front trims shall be "Hinged Trim" type.
- F. Wiring Terminals: Main lugs, sub-feed lugs, neutral/ground bars, and all circuit breaker terminals shall be UL listed as suitable for use with 75°C conductors.
1. Bussing shall be pre-drilled by the manufacturer to accommodate field installable options; sub-feed lugs, through-feed lugs, or sub-feed breakers.
- G. Circuit Breakers: Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating, and have common trip on all multiple breakers. Circuit breakers shall be bolt-on type equipped with individually insulated, braced and protected connectors. The front faces of circuit breakers shall be flush with each other. Large permanent individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF.
1. Circuit breakers shall have an interrupting rating as indicated on the Drawings.
 2. Where a panelboard schedule has been provided on the drawings. The contractor shall assemble all breakers according to schedule so that the installation matches the record drawings.
 - a. Where specifically directed during construction, documented deviations may apply.
 - b. Where no panelboard schedule has been provided, single pole breakers shall be mounted at the top of the panel assembly. Two and three pole breakers shall be mounted at the bottom of the panel, below all single-pole devices and provisions.
 3. Fire alarm circuit - Breakers that serve as the disconnecting means for any fire alarm circuit, shall conform to the following;
 - a. Furnished and installed with manufacturer approved breaker lock, able to be secured in the "ON" position.
 - b. Provide permanent indication or marking of fire alarm circuit, by one of the following methods;
 - 1). A special "fire alarm circuit breaker" with a red breaker handle and factory marking on breaker to read "FIRE ALARM CIRCUIT" as provided by the manufacturer.

- 2). A permanently affixed factory installed label/nameplate, red with white letters, that reads "FIRE ALARM CIRCUIT". The label shall not damage the breaker or obscure the manufactures markings.
 4. Provisions for additional breakers shall be provided so that no additional connectors or mounting hardware is required to add breakers. All spaces listed as provisions on the Panelboard Schedule shall be installed with filler plates that allow installation of future breakers.
 5. Main breakers shall be individually mounted separate from branch breakers. Back-fed branch breakers may not be used as main breakers unless specifically noted otherwise on the drawings.
- H. Integrated Equipment Rating: Each panelboard, as complete unit, shall have a rating equal to or greater than the integrated equipment rating shown on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Securely anchor panelboards to building structure. Terminate all feeder and branch circuit conductors required by the Drawings.
- B. The grounded side of each branch circuit shall be fed directly from the neutral bus. The circuit breaker shall feed the ungrounded phase conductor of each branch circuit.
- C. Provide engraved nameplates in accordance with the identification requirements of Specification Section 260051, paragraph 1.15.
- D. Provide a typed panelboard directory card in each panel as described in Specification Section 260051, paragraph 1.16.
- E. Each recessed panelboard shall have one (1) 1" and three (3) 3/4" spare conduits stubbed up into the nearest accessible ceiling space. Raceways from corridor panels shall be stubbed to the corridor side of the panel unless mechanical or other obstructions will prevent or severely limit the use of the raceways in the future.
- F. Refer to Specification Section 260120 for additional information and requirements regarding termination.

END OF SECTION 26 01 65

SECTION 26 01 66-LOADCENTERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish equipment, materials, tools, labor, and supervision necessary to install load centers as specified in this Section and as called for on the Drawings.

1.03 STANDARDS AND CODES

- A. Fabrication and installation shall comply with applicable Sections of NEC, Article 408 and NEMA Standards.
- B. All load centers shall be UL listed, labeled, manufactured and tested in accordance with the latest standards of the following:
 - 1. UL 50 – Enclosures for Electrical Equipment, Non-Environmental Considerations
 - 2. UL 67 – Standards for Panelboards
 - 3. UL 489 – Standards for Molded Case Circuit Breakers

1.04 DESCRIPTION

- A. Load centers described in this Section shall be dead-front, safety type furnished with plug on thermal-magnetic molded case circuit breakers for lighting, receptacle and branch circuit applications. Circuit breakers shall have frame and trip ratings as scheduled on the Drawings.

1.05 QUALIFICATIONS

- A. Refer to Specification Section 260051, paragraph 1.10 for acceptable manufacturers.

1.06 SUBMITTALS

- A. Shop drawings to include fabrication details, lug and bus arrangement, ampere and voltage rating, breaker frame sizes and interrupting ratings.

PART 2 PRODUCTS

2.01 LOADCENTERS

- A. Panel shall be the "riser" type and have an offset interior to allow riser cable to pass through the enlarged tub. Furnish and install tap lugs as required. Refer to loadcenter riser diagram for details.
- B. Bussing Assembly: Loadcenter bus structure and main lugs or main breaker shall have current ratings as shown on the Drawings. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single phase, three-wire panelboard bussing shall be configured such that any two adjacent single-pole breakers are connected to opposite polarities in such a manner that two-pole breakers can be installed in any location. Current-carrying parts of the bus assembly shall be plated. Main bus ratings shall be as described on the Drawings.
- C. A fully rated copper neutral bus shall be provided. The neutral bus shall have conductor landing capacity appropriate for the feeder (and bonding jumper, where appropriate) and phase pole count for the panel.
- D. A copper equipment ground bus shall be provided in each panel. The bus shall have conductor landing capacity appropriate for the feeder (and neutral bonding, where appropriate) and minimum of 50% of the phase pole count for the panel.
- E. Safety Barriers: The panelboard interior assembly shall be dead front type.
- F. Cabinets and Fronts:

Panelboard assembly shall be enclosed in a hot zinc dipped galvanized steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets.

Wiring gutters shall be in accordance with UL Standard 67 for panelboards.

Fronts shall include hinged doors with latch. Doors shall be mounted by completely concealed steel hinges. A plastic directory sleeve and card provided on the inside of the door. The directory shall be typed to identify the load fed by each circuit. Fronts shall be for flush mounting with 5/8" overlap of tub, made of code gauge full finished steel with rust-inhibiting primer and white baked enamel finish. Fronts shall be of the flat cover design.

1. Eaton Tru Flat cover with white finish.
 2. ABB (General Electric) Flat cover with white finish.
 3. Square D Flat cover with white finish.
 4. Siemens Flat cover with white finish.
- G. Wiring Terminals: Main lugs, sub-feed lugs, neutral/ground bars, and all circuit breaker terminals shall be UL listed as suitable for use with 75°C conductors.
- H. Circuit Breakers: Circuit breakers shall be quick-make, quick-break, thermal-magnetic, trip indicating, and have common trip on all multiple breakers. Circuit breakers shall be plug-on type. The front faces of circuit breakers shall be flush with each other. Large permanent individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF.
1. Circuit breakers shall have an interrupting rating as indicated on the Drawings.
 2. Branch circuit breakers shall be combination type arc fault (AFCI).
 3. Where indicated on drawings provide dual function arc fault/ground fault type breakers.
 4. Main breakers shall be individually mounted separate from branch breakers. Back-fed branch breakers may not be used as main breakers.
 5. Provisions for additional breakers shall be provided so that no additional connectors or mounting hardware is required to add breakers. All spaces listed as provisions on the Loadcenter Schedule shall be installed with filler plates that allow installation of future breakers.
- I. Integrated Equipment Rating: Each panelboard, as complete unit, shall have a rating equal to or greater than the integrated equipment rating shown on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Securely anchor loadcenters to building structure. Terminate all feeder and branch circuit conductors required by the Drawings.
- B. The grounded side of each branch circuit shall be fed directly from the neutral bus. The circuit breaker shall feed the ungrounded phase conductor of each branch circuit.
- C. Provide self-laminated label ON INSIDE of door to identify loadcenter in accordance with the identification requirements of Specification Section 26 00 51, paragraph 1.15.
- D. Provide a typed panelboard directory card in each panel as described in Specification Section 26 00 51, paragraph 1.16.
- E. Refer to Specification Section 26 01 20 for additional information and requirements regarding termination.

END OF SECTION 26 01 66

SECTION 26 01 70-DISCONNECT SWITCHES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide material, equipment, labor, and supervision as required for the complete installation of fused and non-fused disconnect switches as required by the Drawings and this Specification.

1.03 CODES AND STANDARDS

- A. All switches shall be UL listed and labeled. Disconnect switches and accessories shall be designed, manufactured and tested in accordance with the latest applicable standards of the following:
 1. UL 98 – Enclosed and Dead-Front Switches
 2. NEMA KS-1 – Heavy Duty Enclosed and Dead-Front Switches

1.04 QUALIFICATIONS

- A. Refer to Specification Section 260051, paragraph 1.10 for acceptable manufacturers.

1.05 SUBMITTALS

- A. Submittal data shall be standard catalog information showing necessary technical data, including switch name (per the drawings), dimensions, conduit entry/exit locations, switch ratings, compatible fuse type (where applicable), and conductor termination size.

PART 2 PRODUCTS

2.01 GENERAL

- A. Disconnect switches shall be heavy duty type enclosed switches of quick-make, quick-break construction.
- B. All switches shall be horsepower and I²t rated.
- C. All wiring terminals, neutral bars, and ground bars shall be UL listed as suitable for use with 75°C conductors, and shall be capable of accepting aluminum or copper conductors.
- D. The operating handle shall be integral to the enclosure and not the door, directly drive the switch mechanism, and be suitable for padlocking in the "OFF" position with up to 3 padlocks of 5/16" diameter shanks.
- E. Defeatable, front accessible interlocks shall be provided to prevent the opening of the door when the switch is in the "ON" position and prevent turning the switch "ON" when the door is open. Door shall include factory installed "ON-OFF" indication.
- F. Switches shall be arranged for Class J fuses or contain Class R rejection clips to accept only current-limiting fuses where fused disconnects are specified.
- G. The interior shall be easily removable. At least one side wiring gutter shall be clear of any obstructions and moving parts.
- H. Enclosures shall be of the following types, unless noted otherwise on the Drawings:
 1. NEMA Type 1 in dry locations.
 2. NEMA Type 3R (rain-tight) in damp locations, wet locations, or where exposed to weather.
 3. NEMA Type 4X (stainless steel) in corrosive locations or where exposed to water spray down.
- I. Auxiliary contacts shall be provided for all switches installed on the load side of a VFD, to facilitate remote shutdown of the VFD when the switch is "OFF".

- J. Current ratings, voltage ratings, and number of poles shall be as indicated on the Drawings.
- K. Each enclosure shall contain a factory ground lug to accept incoming and outgoing ground conductors.
- L. Each enclosure shall contain a factory neutral lug to accept incoming and outgoing neutral conductors (where indicated on the Drawings).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Securely anchor disconnect switches to structure or equipment housing and make wiring connections as indicated on the drawings.
- B. Furnish and install an engraved nameplate on front trim of each switch enclosure to identify load served, in accordance with the identification requirements of Section 26 00 51.
- C. Refer to Specification Section 26 01 20 for additional information and requirements regarding termination.

END OF SECTION 26 01 70

SECTION 26 01 81-FUSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide material, equipment, labor, and supervision as required to install the proper size and type of fuse in all fusible equipment, including but not limited to service equipment, switchboards, panelboards, motor control centers, motor starters and miscellaneous fusible disconnect switches.

1.03 CODES AND STANDARDS

- A. All fuses shall be UL listed and so labeled.

1.04 QUALIFICATIONS

- A. Fuses shall be Bussmann, Littlefuse, or Mersen.
- B. Refer to Specification Section 260051, paragraph 1.10.

PART 2 PRODUCTS

2.01 GENERAL

- A. The Electrical Contractor shall furnish and install a complete set of fuses for all fusible equipment on the job. Unless otherwise noted all fuses shall be UL listed, current-limiting and have an interrupting rating of 200,000 RMS amperes symmetrical.
- B. All fuses rated 600 amperes or less shall be time-delay current-limiting UL Class J, unless otherwise noted. They shall be:
 - 1. Bussmann Low Peak; LPJ
 - 2. Littlefuse Power Pro; JTD
 - 3. Mersen Amp-Trap 2000; AJT
- C. Where specifically called for on the drawings, or required for installation in existing equipment Class RK1 fuses rated at 600 amperes or less shall be time-delay current-limiting as follows:
 - 1. Bussmann Low Peak; LPN-RK (250V), LPS-RK (600V)
 - 2. Littlefuse Power Pro; LLN-RK (250V), LLS-RK (600V)
 - 3. Mersen Amp-Trap 2000; A2D R (250V), A6DR (600V)
- D. All fuses rated 601 through 6000 amperes shall be current limiting UL Class L. They shall be:
 - 1. Bussmann Hi-Cap; KRP-C
 - 2. Littlefuse; KLP-C
 - 3. Mersen Amp-Trap; A4BQ

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install proper size and type fuse in all fusible equipment. Arrange fuses so rating information is readable without removing fuse.
- B. Fuses shall not be installed until equipment is ready to be energized. All fuses shall be of the same manufacturer to assure coordination.
- C. Spare fuses amounting to 20% (minimum three) of each type and rating shall be supplied by the Electrical Contractor. These shall be turned over to Owner upon project completion. Fuses shall be contained and cataloged within the appropriate number of spare fuse cabinets, located in the electrical rooms as indicated on the drawings.

END OF SECTION 26 01 81

SECTION 26 02 16 - STANDBY POWER GENERATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide labor and material necessary to install a natural gas stand-by emergency engine generator set of the latest commercial type and design as specified herein.

1.03 QUALIFICATIONS

- A. Standby generators and associated accessories (battery chargers, remote annunciators, EPO buttons, etc.) shall be furnished and serviced by one of the following equipment suppliers:
 - 1. Basis of Design (Existing equipment Manufacturer):
 - a. Kohler Power Systems as represented by Buckeye Power Sales of Twinsburg, Ohio (contact: Mr. Connor Young, telephone 614-315-6963).
 - 2. Alternate Manufacturers.
 - a. Ohio CAT of Broadview Heights, Ohio (contact: Mr. Mark Gibson, telephone 1-440-526-0520 ext. 7142).
 - b. Cummins Bridgeway Power, (Cummins Power Generation) of Cleveland, Ohio (contact: Mr. John Prochaska, telephone 1-440-735-2140).
 - c. W. W. Williams (MTU), of Brunswick, Ohio (contact Mr. Joseph Dolence, telephone 330-730-0324).
 - d. Generator Systems (Generac), of Medina, Ohio (contact Mr. Jeff Gleason, Telephone 330-630-0890)
- B. The equipment described in these specifications is based on Kohler equipment. Equipment suppliers (listed above) are responsible for verifying the proposed equipment meets or exceeds all requirements of the Specifications. Any/all exceptions to the bid documents must be identified in writing on the Form of Proposal.
 - 1. The EC to be responsible for confirming dimensions of all alternate equipment within areas to be installed.
- C. All engine generator set accessories specified in this section shall be furnished by the engine generator supplier unless noted otherwise.
- D. The specified standby rating indicated on plans shall be for continuous electrical service during interruption of normal utility source and shall be certified to this effect by the manufacturer for the actual unit supplied.
- E. All ratings must be substantiated by manufacturer's standard published curves. Special ratings or maximum ratings are not acceptable.

1.04 SUBMITTALS

- A. The successful contractor shall supply quantity of complete instruction manuals, including schematics, wiring diagrams, complete parts lists of all major components, plus operating service and preventative maintenance instructions as indicated in Section 26 00 51 of this Specification. Submittals shall include the following:
 - 1. Engine generator set including plans and elevations clearly indicating entrance points for each of the interconnections required.
 - 2. Engine generator and control panel.
 - 3. Fuel consumption rate curves at various loads, ventilation and combustion CFM requirements.
 - 4. Exhaust muffler, vibration isolators, battery charger, batteries and battery rack.
 - 5. Weather-resistant enclosure and sub-bas fuel tank.
 - 6. Remote annunciator and EPO pushbutton.
 - 7. Electrical diagrams including schematic diagrams, and interconnections wiring diagrams for all equipment to be provided.
 - 8. Legends for all devices on all diagrams.
- B. Submittals shall include complete coordination of the engine generator system with the automatic transfer switch in the form of a complete wiring diagram which shows all generator controls, and transfer system controls, remote annunciator and emergency off pushbutton.

1.05 STANDARDS

- A. Generator shall meet all NFPA 110 requirements for a Level 1 system.
- B. Generators shall comply with applicable sections of the NEC, NFPA 99, NFPA 101, and NFPA 110.

1.06 MATERIALS AND WORKMANSHIP

- A. All materials and parts comprising the units herein specified shall be new and unused, of current manufacturer, and of the highest grade, free from all defects and imperfections affecting performance. Workmanship shall be of the highest grade, in accordance with modern practice. The transfer switch assembly shall be manufactured in the United States by companies currently engaged in the production of such equipment.

1.07 WARRANTY

- A. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under terms of the manufacturer's and dealer's standard warranty. But, in no event, shall it be for a period of less than five years from date of initial start-up of the system. Comprehensive warranty shall include parts, labor, and travel time for necessary repairs at the job site.

PART 2 - PRODUCTS

2.01 STANDBY DIESEL GENERATOR

- A. Standby diesel genset shall consist of a 6 cylinder, 4 cycle engine, diesel generator set directly connected to a single bearing synchronous generator, rated at 150 KW, 187.5 KVA, 208/120V, 3Ø, 4W, 60 Hz at 1800 RPM. The engine shall be EPA Tier 3 certified and operate on number 2 diesel fuel. The engine shall be equipped with fuel, lube oil, and intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter, gear-driven water pump. Genset shall be complete with all standard accessories and shall contain the following factory installed items:
1. Cooling system: Unit mounted radiator with fan, water pump and radiator duct adapter flange. Provide low coolant shutdown, which shall activate high engine temperature lamp and shutdown.
 2. Engine-generator set control: Provide a lighted unit mounted control module that is factory built, wired, tested, and shock mounted by the generator manufacturer. It shall be capable of starting the engine from a remote closing relay, stopping on opening the relay, and shall contain the following instruments: Oil pressure gauge, coolant temperature gauge, charge rate ammeter and running time meter. Manual selector switch, run-stop remote, remote two wire start-stop terminals, and auxiliary engine run relay with form "C" auxiliary contact to operate when engine runs for louvers, fan or other signal indicating engine is running.
 3. Alternator: Permanent magnet exciter to provide 300% rated current for ten (10) seconds.
 - a. The insulation material shall meet NEMA standards for Class H insulation and shall be UL1449 Recognized and CSA Certified, and shall be vacuum impregnated with epoxy varnish to be fungus resistant. Temperature rise of the rotor and stator shall not exceed 125^oC rise by resistance over 40^o C ambient.
 - b. The (SKVA) shall be 570 SKVA for starting motor loads with a maximum instantaneous voltage dip of 35%.
 4. Digital Voltage Regulator: A three phase sensing generator-mounted, volts-per-hertz-type exciter/regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be + 0.25% from no load to full rated load. Readily accessible voltage droop, voltage level, and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of + 5%. The solid-state regulator module shall be shock-mounted and epoxy-encapsulated for protection against vibration and atmospheric deterioration.
 5. Output breakers: The generator terminal compartment shall be furnished with three (3) 100% rated 3-pole manually operated molded-case AC output circuit breakers. One rated for 250A, one rated for 225A, and one rated for 100A.
 - a. Breakers shall have two normally-open auxiliary contacts, to close when the breaker is opened.
 - b. Breaker shall have lug landings suitable for the termination of the copper feeder cables.

6. Automatic start/stop controls.
 - a. Automatic shut-down for high water temperature, low oil pressure, and overspeed shall be provided at the generator.
 - b. Provide auxiliary alarm contacts for the following remote monitored conditions:
 - 1). Approach low oil pressure
 - 2). Approach high coolant temperature
 - 3). Low oil pressure
 - 4). Low coolant temperature
 - 5). High coolant temperature
 - 6). Low coolant temperature
 - 7). Overspeed
 - 8). Engine cranking
7. Gauges: Oil pressure, water temperature and fuel pressure gauges shall be provided at the generator.
8. Starter: A 12 VDC electric starting system with positive engagement shall be furnished.
9. Muffler: Furnish a critical grade silencer (EM Products type JCS) complete with muffler companion flanges, and properly sized flexible stainless steel exhaust fitting per manufacturer's recommendations to the Mechanical Contractor for installation.
 - a. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine.
 - b. The engine manufacturer shall size exhaust pipe to ensure that back pressure does not exceed the maximum limitations provided by the engine manufacturer.
 - c. The muffler and all indoor exhaust piping shall be lagged by the Mechanical Contractor to maintain a surface temperature not to exceed 150 degrees Fahrenheit. The insulation shall be installed so that it does not cover or interfere with the functioning of the flexible exhaust fitting.
10. Cooling Radiator: Factory installed engine driven fan cooled vertical core radiator complete with cooling system connections and filled with a solution containing 50% ethylene glycol.
 - a. A radiator with blower type fan shall be sized to maintain safe operation at 110 degrees Fahrenheit ambient temperature. Cooling system shall provide proper cooling with no more than 0.5" H₂O back-pressure external to the engine.
 - b. The engine cooling system shall be pre-treated by the engine supplier for the inhibition of internal corrosion.
11. Alternator space heater to inhibit condensation.

12. Mounting: The unit shall be mounted on a structural steel sub-base and shall be provided with suitable neoprene rubber vibration isolators.
13. Batteries: Lead acid sealed type storage batteries shall be used in conjunction with the electric starting system provided. The battery shall be provided complete with rack, cables and clamps sized to provide 90 seconds of engine cranking at a battery temperature of 50°F.
14. Battery charger and required accessories to automatically recharge the generator starting batteries.
 - a. A battery charger shall be furnished to automatically recharge the generator starting batteries. Charger and all accessories shall be contained in a wall mounting type in NEMA 1 enclosure.
 - b. Charger shall float at 1.45 volts per cell and equalize at 1.6 volts per cell. Charger shall be current limiting, with integral overload protection, silicon diode full wave rectifiers, voltage surge suppressor, fused AC input, and fused DC output.
 - c. AC input voltage shall be 120 volts, single phase. DC output voltage shall be 24 volts. Output amperage shall be rated at 10 amperes.
 - d. Charger shall contain a combination digital DC ammeter/voltmeter and digital equalize timer. adjustable from 1 to 144 hours.
 - e. Charger shall contain integral individual alarm LED indicating lights (for local alarm annunciation), each with auxiliary form C dry contacts (for remote annunciation) for each of the following conditions:
 - 1). Low battery voltage.
 - 2). High battery voltage.
 - 3). Low battery current.
 - 4). AC power failure.
 - 5). Rectifier failure.
15. Battery charging alternator.
16. Rodent Guard
17. Jacket Water Heater: Unit mounted thermal circulation type water heater incorporating a line-voltage thermostatic switch to maintain engine jacket water to 90 degree Fahrenheit. The heater shall be 3 KW, 208V, 1Ø, 60 Hz.

2.02 GENERATOR CONTROL PANEL

- A. Control panel shall include:
 1. A backlight graphical display with text-based alarm/event descriptions.
 2. Audible horn for alarm and shutdown with horn silence switch.
 3. Remote start/stop control.
 4. Local run/off/auto control integral to system microprocessor.
 5. Cool-down timer.

6. Speed adjust.
 7. Lamp test.
 8. Voltage adjust.
 9. Voltage regulator V/Hz slope-adjustable.
 10. Password protected system programming.
- B. Indicating Digital Readouts: As required by NFPA 110 for Level 1 system and the following:
1. AC volts.
 2. AC amps.
 3. AC frequency.
 4. KW.
 5. kVA.
 6. kVAR.
 7. Power Factor.
 8. KWH.
 9. Exciter voltage and current.
 10. DC voltmeter (alternator battery charging).
 11. Engine-coolant temperature.
 12. Engine lubricating-oil pressure.
 13. Engine lubricating-oil temperature.
 14. Running-time meter.
 15. Ammeter-voltmeter, phase-selector switches.
 16. Generator-voltage adjusting rheostat.
 17. Fuel tank derangement alarm.
 18. Fuel tank high-level shutdown of fuel supply alarm.
 19. Generator overload.
 20. Engine RPM.
- C. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
1. Overcrank shutdown.
 2. Coolant low-temperature alarm.
 3. Coolant high-temperature alarm.
 4. Coolant high-temperature shutdown.
 5. Low coolant level.
 6. Loss of coolant shutdown.

7. Control switch not in auto position.
 8. Battery-charger malfunction alarm.
 9. Battery low-voltage alarm.
 10. Battery high-voltage alarm.
 11. Low oil pressure warning.
 12. Low oil pressure shutdown.
 13. Overspeed shutdown.
- D. Generator Alarm/Shutdown
1. Generator over voltage.
 2. Generator under voltage.
 3. Generator over frequency.
 4. Generator under frequency.
 5. Generator reverse power.
 6. Generator overcurrent.
- E. Voltage Regulator Alarm/Shutdown
1. Loss of excitation alarm/shutdown.
 2. Instantaneous over excitation alarm/shutdown.
 3. Time over excitation alarm/shutdown.
 4. Rotating diode failure.
 5. Loss of sensing.
 6. Loss of PMG.
- F. Generator exerciser:
1. Programmable cycle timer that starts and runs the generator for a predetermined time. The timer shall use 14 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:
 - a. Day of week.
 - b. Time of day to start.
 - c. Duration of Cycle.

- G. "Generator Stop" pushbutton on control panel, inside weather resistant housing.
- H. Additional auxiliary output relays to indicate generator running and generator summary alarm for interface with Fire Alarm System. Refer to plans.

2.03 WEATHER RESISTANT HOUSING / FUEL TANK

- A. The generator and all associated equipment shall be housed in a sound attenuated, weather-resistant outdoor enclosure containing and enclosing the entire generator assembly. Housing to be sheet metal type with removable side panels and removable hinged doors. The housing shall provide adequate cooling and combustion air to allow for operation with the door closed and all panels assembled. A critical type muffler shall be installed within-in housing with a rain cap installed on the muffler exhaust pipe. Sound rating of unit shall be 73 dba (maximum) at 23'-0".
- B. The enclosure shall have beige or green painted finish.
- C. The enclosure shall be furnished without external "Generator Stop" pushbutton, pushbutton shall be installed on control panel, inside housing.
- D. The enclosure shall be furnished with convenience outlet: GFCI duplex receptacle with weather-resistance cover.
- E. The assembly shall sit on a U.L. 142 listed double wall diesel fuel tank (State Tank) with leak detector and all accessories required to meet Ohio Rule 34. The tank shall be sized to operate the generator for 24 hours at rated full load. Tank shall minimally include the following:
 - 1. Low fuel level switch
 - 2. Leak detection switch
 - 3. Fuel level gauge
 - 4. 5 gallon spill container on fuel fill nozzle
 - 5. 2" fittings for 1) engine supply, 2) engine return dip tubes, and 3) optional accessory.
 - 6. High fuel alarm panel
 - 7. Vent extending 12'-0" above grade.
 - 8. Generator set/tank dimensions shall not exceed 15'-0"L x 4'-0"W.
- F. Equipment supplier shall perform on site fuel tank pressurization test as required by Ohio Rule 34.

2.04 REMOTE ANNUNCIATOR PANEL

- A. Provide a remote annunciator to meet the requirements of NFPA 110, Level 1. The remote annunciator shall provide remote annunciation of all points listed herein and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the integral horn. Remote annunciator shall provide ATS source availability, contactor position (for each ATS), and loaded and unloaded test for up to four ATS. Provide alarm indication for the following:
 - 1. Low oil pressure
 - 2. High coolant temperature

3. Low coolant level
 4. Overspeed
 5. Overcrank
 6. Emergency stop depressed
 7. Approaching high coolant temperature
 8. Approaching low oil pressure
 9. Low coolant temperature
 10. Low voltage in battery
 11. Control switch not in auto position
 12. Battery charger AC failure
 13. High battery voltage
 14. EPS supplying load
 15. Low fuel level
 16. Fuel tank leak
 17. Spare
- B. The remote annunciator shall be provided with the following additional features:
1. Lamp Test Pushbutton
 2. ATS Controls
 - a. Push-to-Test button for each transfer switch (for up to 4). This option shall be capable to remotely start generator and individually transfer each transfer switch from normal to emergency.
 - b. ATS position indicator (normal or emergency)
 - c. Power source indicator (normal or emergency)
 - d. Key operated lock/unlock switch for safety
 3. Alarm Mute Pushbutton
 4. Normal/Run Control Switch
 5. Backbox and trim for recessed mounting flush in wall.

2.05 EPO BUTTONS

- A. Provide one EPO button (emergency stop pushbutton) for remote mounting, to shutoff generator. EPO button shall be a Pilla Model #ST120 surface mounted break glass station with pushbutton, momentary contact and "Emergency Generator Stop" legend.

2.06 SPARE PARTS

- A. Spare fuses amounting to 10% (minimum two) of each type and rating installed for control panel, and battery charger, control power transformers and meters shall be supplied by the Electrical Contractor.
- B. Spare indicating lights amounting to one per each type installed shall be supplied by the Electrical Contractor.

- C. Spare filters, one set each of lubricating oil, fuel and combustion air.
- D. Spare equipment shall be turned over to Owner upon project completion. Equipment shall be contained in protective package and labeled.

2.07 SERVICE CONTRACT

- A. The Equipment Supplier shall include a 1 (one) year maintenance service agreement as part of the base bid. The agreement shall commence upon Owner's acceptance of the generator installation and include two visits at six month intervals. Equipment Supplier shall include an outline of services to be provided in this agreement with his proposal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Electrical Contractor shall make all required wiring connections for generator and all generator accessories.
- B. Generator shall be set on a concrete isolation pad furnished by the Electrical Contractor.
- C. The Electrical Contractor shall install generator, and all associated accessories per the manufacturer's installation instructions.
- D. Concrete Pad: Electrical Contractor shall construct a 12" high steel reinforced concrete pad for the emergency generator per manufacturer's recommendations.
 - 1. Concrete pad will contain box-outs for conduit and gas line entries and four (4) 48" deep post-hole foundations.
- E. Exact generator locations and associated conduit rough-in locations shall be determined by the Electrical Contractor based on approved manufacturer's shop drawings.
- F. The Electrical Contractor shall apply for a Fuel Storage Tank Permit with the State of Ohio and arrange for inspection and witness test of tank pressurization test. Contact the Ohio Department of Commerce, State Fire Marshal Division, telephone 614-728-5460.
- G. The Electrical Contractor shall be responsible for providing #2 diesel fuel for generator testing and filling the fuel tank to full capacity prior to turning the system over to the Owner.

3.02 SYSTEM START-UP

- A. On completion of the installation, start-up shall be performed by the engine manufacturers' factory trained service representative.

3.03 TESTING

- A. Manufacturer to perform on-site load bank testing and system commissioning in the presence of the Owner's representative.
- B. Load bank testing shall be performed on engine for a period of four (4) hours under full load.
- C. In the event of any failure, testing shall be restarted unless waived in writing by the Owner.

- D. Equipment supplier shall perform on site fuel tank pressurization test as required by Ohio Rule 34.

3.04 OPERATION AND MAINTENANCE MANUALS

- A. Equipment Supplier shall furnish to the Owner operation/maintenance manuals as described in the Division 1 Specifications.
- B. Manuals shall minimally include three (3) individually bound and indexed (thumb tabbed) manuals. Each manual shall provide operating instructions, maintenance manuals, spare parts listing, copies of warranties, wiring diagrams, inspection procedures and shop drawings on all equipment and systems.
- C. Each manual shall be bound in a heavy-duty, 3 inch; three-ring vinyl covered binder with pocket folders for drawings and folded sheet information. Each binder shall be identified on both the front and the spine.

3.05 TRAINING

- A. Upon completion of the on-site testing and system acceptance the manufacturer shall provide the following:
 - 1. Operation and maintenance instruction manuals. Submit operation and maintenance manuals two (2) weeks prior to on-site operating training.
 - 2. Four hours of on-site operation training during which all routine operation, testing and maintenance procedures are explained. (Operation and maintenance manuals shall be available to Owner's staff during training).

END OF SECTION

SECTION 26 02 50 - AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide material, equipment, labor and supervision as required to install the automatic transfer switches, as shown on the drawings.

1.03 QUALIFICATIONS

- A. Transfer equipment shall be as furnished and serviced by one of the following equipment suppliers:
 - 1. Basis of Design (Existing equipment Manufacturer):
 - a. Kohler Power Systems as represented by Buckeye Power Sales of Twinsburg, Ohio (contact: Mr. Connor Young, telephone 614-315-6963).
 - 2. Alternate Manufacturers. The EC to be responsible for confirming dimensions of all alternate equipment within areas to be installed.
 - a. Ohio CAT of Broadview Heights, Ohio (contact: Mr. Mark Gibson, telephone 1-440-526-0520 ext. 7142).
 - b. Cummins Bridgeway Power, (Cummins Power Generation) of Cleveland, Ohio (contact: Mr. John Prochaska, telephone 1-440-735-2140).
 - c. W. W. Williams (MTU), of Brunswick, Ohio (contact Mr. Joseph Dolence, telephone 330-730-0324).
 - d. Generator Systems (Generac), of Medina, Ohio (contact Mr. Jeff Gleason, Telephone 330-630-0890)
- B. The equipment described in these specifications is based on Kohler equipment. Electrical Contractor's responsible for verifying the proposed equipment meets or exceeds all requirements of the Specifications. Any/all exceptions to the bid documents must be identified in writing on the Form of Proposal.
 - 1. The EC to be responsible for confirming dimensions of all alternate equipment within areas to be installed.
- C. Transfer switches shall be (1) 260A3P, (1) 230A3P, and (1) 100A3P, open transition, dual operator type with solid neutral in a NEMA 1 enclosure as described below.

1.04 SUBMITTALS

- A. The Contractor shall supply quantity of complete instruction manuals, including schematics, wiring diagrams, complete parts lists of all major components, plus operating service and preventative maintenance instructions as indicated in Section 26 00 51 of this Specification.

- B. Submittals shall include complete coordination between the generator, transfer switch and remote annunciator in the form of a composite wiring diagram showing all interface controls and control wiring.

1.05 STANDARDS

- A. Transfer switches shall be UL listed under UL Standard 1008.
- B. Transfer switches shall comply with applicable sections of the NEC, NFPA 99, NFPA 101, and NFPA 110.

1.06 MATERIALS AND WORKMANSHIP

- A. All materials and parts comprising the units herein specified shall be new and unused, of current manufacturer, and of the highest grade, free from all defects and imperfections affecting performance. Workmanship shall be of the highest grade, in accordance with modern practice. The transfer switch assembly shall be manufactured in the United States by companies currently engaged in the production of such equipment.

1.07 WARRANTY

- A. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under terms of the manufacturer's and dealer's standard warranty. But, in no event, shall it be for a period of less than five years from date of initial start-up of the system and shall include labor and travel time for necessary repairs at the job site.

PART 2 - PRODUCTS

2.01 TRANSFER SWITCHES

- A. Each transfer switch assembly shall be listed under UL-1008 for use on emergency systems. The switches shall be capable of switching all classes of loads and shall be rated for continuous duty when installed in a non-ventilated enclosure.

2.02 Equipment ATS "ATS-EQ1" – Shall be rated 260A, 3-pole, 208/120 volt, 3 phase, 4 wire with dual motor operators, open-transition transfer switch.

- A. Open transition shall be key switch selectable.
- B. When operating in the open transition mode, there shall be an adjustable time delay between the opening of the closed contacts and the closing of the open contacts to allow the loads to be demagnetized before transfer.
- C. The dual operator transfer switches shall allow the transformer loads to be re-energized after transfer with normal inrush current.

2.03 Equipment ATS "ATS-EQ2" – Shall be rated 230A, 3-pole, 208/120 volt, 3 phase, 4 wire with dual motor operators, open-transition transfer switch.

- A. Open transition shall be key switch selectable.
- B. When operating in the open transition mode, there shall be an adjustable time delay between the opening of the closed contacts and the closing of the open contacts to allow the loads to be demagnetized before transfer.
- C. The dual operator transfer switches shall allow the transformer loads to be re-energized after transfer with normal inrush current.

- 2.04 Life Safety ATS "ATS-LS" – Shall be rated 100A, 4-pole, 208/120 volt, 3 phase, 4 wire with dual motor operators, open-transition transfer switch.**
- A. Open transition shall be key switch selectable.
 - B. When operating in the open transition mode, there shall be an adjustable time delay between the opening of the closed contacts and the closing of the open contacts to allow the loads to be demagnetized before transfer.
 - C. The dual operator transfer switches shall allow the transformer loads to be re-energized after transfer with normal inrush current.
- 2.05 All factory bus shall be copper, sized for maximum current density of 1000 amperes per square inch. A solid neutral bus and ground bus shall be provided with provisions suitable for termination of all incoming and outgoing conductors.
- A. Main contacts shall be machined from solid copper and shall be segmented with tungsten arcing tips.
 - B. Separate arcing contacts with magnetic blowouts shall be provided.
 - C. All bolted bus connections shall have Belleville compression type washers.
 - D. NEMA two-hole, long barrel, dual-crimp, compression type lugs with inspection ports shall be furnished and bolted to the factory bus for all incoming and outgoing cable type feeders.
 - E. Where feeder bus duct is specified, internal ATS bus structure shall be arranged to match the selected feeder bus manufacturers flanged end configuration.
- 2.06 Automatic transfer switches shall be electrically operated and mechanically held with double throw construction.
- A. Main contacts shall be mechanically locked in either position without the use hooks, latches, magnets, or springs.
 - B. They shall be capable of transferring successfully in either direction with 70% of rated voltage applied to the switch terminals.
- 2.07 The transfer switch shall be UL listed, in accordance with UL 1008, for 3 cycle close and withstand ratings. Switches that are not tested and labeled by UL for 3 cycle ratings are not acceptable.
- 2.08 The minimum UL listed close and withstand ratings at 480 VAC shall be:
- A. 3 cycle – 65,000 AIC
- 2.09 During 3 cycle closing and withstand tests current limiting fuses shall not be used, there shall be no contact welding, damage, or separation, and contact continuity shall remain across all phases.
- 2.10 In accordance with UL-1008, after completion of the short time closing and withstand testing, the same sample shall successfully pass the temperature test and the dielectric

- voltage-withstand test to verify the ability of the ATS to carry full rated current after completing the short time tests.
- 2.11 Each transfer switch shall be provided with a microprocessor controller with voltage sensing module, power supply module, CPU, input/output module, Ethernet communications module, graphical display, and navigation keypad.
 - 2.12 The power supply module shall accept an external 24 VDC power source allowing controller communications in the event of a power outage.
 - 2.13 The controller shall connect to the transfer switch through an interconnecting wiring harness and all customer interface connections shall be wired to a common terminal block.
 - 2.14 The controller shall have a graphical display and keypad for viewing data and setting operational parameters.
 - A. A single source status screen shall be provided to allow for viewing of the status of both sources including three phase voltage, power, and frequency.
 - B. Navigational keys shall consist of home, up, down, escape, enter, and help.
 - C. Soft keys shall change function based on user location in the menu structure.
 - D. There shall be dedicated keys for alarm reset, test, control, and information.
 - E. Parameters shall be available for viewing remotely with limited control through a front accessible communications port.
 - F. All programming functions shall be pass code protected.
 - 2.15 The controller shall have high intensity LED's to quickly identify the following:
 - A. Source Availability – Indicates the source voltage and frequency are within pre-set parameters.
 - B. Source Connected – Indicates the source main contacts closed and the load being served from the source.
 - C. Transfer Inhibit – Indicates that the ATS is being inhibited from automatic operation to the unconnected source.
 - D. Alarm – Indicates an alarm condition is active.
 - E. Time Delay Active – Indicates that the ATS time delay is actively timing.
 - 2.16 The controller shall have programmable voltage and frequency sensing of both Source 1 and Source 2.
 - A. The voltage sensing module shall be 600 VAC rated and shall be capable of detecting either single or three phase losses of either source.
 - B. Voltage sensing shall be true RMS type.
 - C. Voltage sensing shall be accurate to +/- 1% of nominal voltage.
 - D. Frequency sensing shall be accurate to +/- 0.05 Hz.

- E. The controller shall have adjustable pickup and dropout settings for each source. Settings shall be adjustable in 1% increments either through the keypad, front communications port, or remotely via Ethernet communications.

Parameter	Dropout/Trip	Pickup/Reset
Under-Voltage	72 to 100%	70 to 98%
Over-Voltage	100 to 108%	102 to 110%
Under-Frequency	45.1 to 60.0 Hz	45.0 to 59.9% Hz
Over-Frequency	50.0 to 69.7 Hz	50.1 to 69.8 Hz

- 2.17 The controller shall monitor phase rotation of both sources and inhibit transfer if both sources are not the same phase rotation. Source rotation shall be field selectable as either ABC or CBA.
- 2.18 The controller shall have adjustable and programmable time delays for both Source 1 and Source 2.
 - A. Engine Start Source 1 – an adjustable 0 to 10 seconds time delay (60 seconds with external 24 VDC control power source) to delay generator starting upon Source 1 power outage.
 - B. Transfer to Source 2 – an adjustable 0 to 60 minute time delay on transfer from Source 1 to Source 2, factory set at 3 seconds.
 - C. Re-transfer to Preferred Source – An adjustable 0 to 259 minute time delay on transfer from alternate to preferred source, factory set at 5 minutes.
 - D. Source 1 and Source 2 Neutral Delay (aka Transition Dwell or Center OFF Delay)
 - 1. Shall be two separate independently adjustable timers that are operable in OPEN transfer mode only and bypassed when in CLOSED transition mode.
 - 2. Transfer Neutral Delay to Source 2 – An adjustable 0 to 10 minute time delay on transfer from preferred to alternate source, factory set at 1 second.
 - 3. Transfer Neutral Delay to Source 1 – An adjustable 0 to 10 minute time delay on transfer from alternate to preferred source, factory set at 1 second.
 - E. Engine Cool Down – An adjustable 0 to 60 minute time delay to keep generator running after transfer to preferred source, factory set at 5 minutes.
 - F. All time delays shall be adjustable in 1 second increments.
 - G. All time delays shall be adjustable via the graphical display, the front communications port, or remotely thru configuration software using the internal Ethernet communications port.

2.19 Sequence of Operation

- A. The automatic transfer switches will transfer between utility and a generator source.
- B. When the voltage on any phase of Source 1 is outside of the acceptable parameters, as defined later in this specification, the transfer switch shall:
 - 1. Close the engine starting contacts, after a programmable time delay period (to allow for momentary voltage dips), to initiate starting of the standby generator.

2. Transfer to Source 2 when that source has reached specified voltage and frequency on all phases and after expiration of transfer time delay.
 - C. After restoration of Source 1 voltage and frequency on all phases, as specified later in this specification, the transfer switch shall:
 1. Retransfer to Source 1, after a programmable time delay period (to allow stabilization of Source 1).
 2. Should Source 2 fail anytime during the time delay period, the transfer switch shall bypass the time delay and immediately retransfer to Source 1.
 - D. After retransfer to Source 1, the standby generator shall be allowed to operate at no load for a programmable period of time.
 1. The transfer switch cool-down timer shall be coordinated with any engine control cool-down timers to avoid excessive unloaded operation.
- 2.20 Transition Mode Selector Switch – A two-position key switch shall be provided to select "CLOSED" or "OPEN" transition mode. The key switch shall be furnished with an engraved nameplate to identify "CLOSED" and "OPEN" key switch positions and to identify key function "TRANSITION MODE SELECTOR SWITCH".
- 2.21 Test Switch – In addition to the controller's dedicated test key, the ATS shall be provided with a toggle type test switch with red safety cover to simulate a Source 1 failure.
- A. The load test toggle switch shall be wired to initiate a load test. The toggle switch shall be furnished with an engraved nameplate to identify "TEST" and "AUTO" positions and identify switch function "LOAD TEST SW".
 - B. The load test toggle switch shall be factory programmed to initiate a "LOAD TEST" and automatically start the generator and transfer the load to the generator Source 2 position.
 - C. The ATS controller shall be field programmable via the display and keypad to allow the switch to also initiate a "NO-LOAD" test without rewiring the test switch.
- 2.22 Engine Start Signal – A SPDT contact, rated 10 amps at 30 VDC, shall be provided to start the engine generator in the event of a Source 1 outage or customer initiated test.
- 2.23 Engine Start on Bypass Signal – a SPDT contact, rated 10 amps at 30 VDC, shall be provided to maintain the engine generator start signal in the event the customer manually bypasses the ATS to Source 2.
- 2.24 Pre-Transfer Contacts – Two (2) voltage free Form "C" contacts shall change state after a programmable time delay prior to transfer in either direction and the contacts shall release after a programmable time delay once the transfer cycle is complete. The time delays shall be independently adjustable.
- 2.25 Source Availability Contacts – Rated 10 amps at 120 VAC shall be provided to signal source availability, as determined by the voltage sensing settings for each source.
- A. Provide two (2) voltage free Form "C" contacts to indicate availability of Source 1.
 - B. Provide two (2) voltage free Form "C" contacts to indicate availability of Source 2.

- 2.26 Source Connected Contacts – Rated 10 amps at 120 VAC shall be provided to signal when the ATS is connected to each source.
- A. Provide two (2) voltage free Form "C" contacts to indicate ATS in Source 1 position.
 - B. Provide two (2) voltage free Form "C" contacts to indicate ATS in Source 2 position.
- 2.27 Bypass Connected Contact – Rated 10 amps at 120 VAC shall be provided to signal when the ATS is connected to each source via the manual bypass handle.
- A. Provide one (1) voltage free normally open contact to indicate ATS bypassed to Source 1.
 - B. Provide one (1) voltage free normally open contact to indicate ATS bypassed to Source 2.
- 2.28 Source LED's – In addition to the controller's LED's, the ATS shall be provided with the following panel mount LED's:
- A. "SOURCE-1 POWER AVAILABLE" – Green LED.
 - B. "SOURCE-1 POSITION" – Green LED.
 - C. "CENTER OFF POSITION" – Amber LED.
 - D. "SOURCE-2 POWER AVAILABLE" – Red LED.
 - E. "SOURCE-2 POSITION" – Red LED.
- 2.29 Bypass switch LED's – the ATS shall be provided with the following panel mount LED's:
- A. "BYPASSED TO SOURCE-1 POWER SUPPLY" – Green LED.
 - B. "ATS ISOLATED" – Amber LED.
 - C. "BYPASSED TO SOURCE-1 POWER SUPPLY" – Red LED.
- 2.30 Lamp Test Pushbutton – A momentary type, flush panel mounted pushbutton shall be provided to illuminate all panel mount LED's. The pushbutton shall be furnished with an engraved nameplate to identify "LAMP TEST".
- 2.31 Bypass Time Delay Pushbutton – A momentary type, flush panel mounted pushbutton shall be provided to bypass the retransfer time delay. The pushbutton shall be furnished with an engraved nameplate to identify "BYPASS TIME DELAY RETRANSFER TO SOURCE-1".
- 2.32 Engine Exerciser (Equipment ATS only) – The controller shall include a user configurable exerciser.
- A. Exerciser shall be configurable for daily, 7 day, 14 day or 28 day exercise periods, each with (7) programmable events.
 - B. The exerciser shall also be configurable as a full, 365 day exerciser with up to 24 independent exercise events.
 - C. Each event shall be configurable for test with load and test without load.
 - D. Each event shall include user adjustable start time, date and test duration.
 - E. All time and date settings shall be stored in non-volatile memory.

- F. The controller shall include full programmability for daylight savings time.
- G. The engine exerciser shall be disabled unless directed otherwise by the Owner.
- 2.33 Diagnostics – The controller shall contain self and system diagnostic screens for the purpose of detecting and troubleshooting abnormal system events.
- 2.34 Communications Interface – The controller shall be capable of interfacing via Ethernet TCP/IP communications ports integral to the controller. All communications parameters (baud rate, parity, IP address, etc.) Shall be accessible and programmable via the front keypad. Ethernet communication shall be Modbus open protocol.
- 2.35** Event Logger – The controller shall have the ability to log data and to maintain the last 256 events, even in the event of a power failure. Time and date stamping of events will be accurate to 1 ms. Controller shall be capable of synchronizing its date/time setting with a main pc via network time protocol over an Ethernet TCP/IP network **connection**.

The following events shall be time and date stamped:

- A. Last primary source failure
 - B. Last reason for transfer.
 - C. Last transfer to alternate source
 - D. Last retransfer to primary source
 - E. Time load is without power
 - F. Time ATS powered up
 - G. Total time on Source 1
 - H. Total time on Source 2
 - I. Total number of primary source failures
 - J. Total number of transfers
- 2.36 Communications Modules**
- A. Ethernet Communications: The controller shall be capable of Ethernet TCP/IP communications via an internally mounted and self powered communications card. Ethernet shall be 10/100 MBit, auto sensing and include an RJ45 network connector.
 - B. Open Protocol: Both serial and Ethernet communications shall be Modbus protocol. Proprietary communications protocols shall not be acceptable.
 - C. External Power Supply: The controller shall be capable of being connected to an external 24 VDC power supply to permit full operation and communications of the controller when both sources are de-energized.
 - D. Auto Load Shed: The controller shall be capable of being programmed to automatically shed the connected load in the event of a user configurable under frequency condition.
 - E. Customer Configurable Alarms: The controller shall be capable of being configured to display customer configured alarm points. Alarms shall be capable of being reset via a remote contact or the front panel reset pushbutton.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Refer to Specification Section 26 01 20 for additional information and requirements regarding termination.
- B. Electrical contractor shall furnish and install fire rated plywood backboard for wall mounting transfer switch assemblies.
- C. Electrical contractor shall furnish and install a concrete housekeeping pad, based on approved shop drawings, for floor mounted transfer switch assemblies.
- D. All interconnect wiring integral to equipment shall be provided by the equipment supplier. All required field wiring shall be provided by the electrical contractor.
- E. The electrical contractor and manufacturer's field service technician shall perform all on-site system testing and system commissioning in conjunction with testing of the engine generator set in the presence of the Owner's representative.
- F. Prior to system start-up, all system control and alarm functions shall be tested and verified by the contractor and manufacturer's service technician. After all testing is completed, the contractor shall submit a letter stating all system requirements are fully operational and comply with the design.

3.02 TESTING

- A. The Electrical Contractor and manufacturer's field service technician shall perform all on-site system testing and system commissioning in conjunction with testing of the engine generator set in the presence of the Owner's representative.
- B. Manufacturer field service technician to perform on-site load bank testing in the presence of the Owner's representative.
- C. Upon completion of the emergency power system Electrical Contractor shall set and test breaker trip settings. Settings shall be directed by the Engineer.
- D. Prior to system start-up, all system control and alarm functions shall be tested and verified by the contractor and manufacturer's service technician. After all testing is completed; the Contractor shall submit a letter stating all system requirements are fully operational and comply with the design.

3.03 OPERATION AND MAINTENANCE MANUALS

- A. Equipment Supplier shall furnish to the Owner operation/maintenance manuals as described in the Division 1 Specifications.
- B. Manuals shall minimally include three (3) individually bound and indexed (thumb tabbed) manuals. Each manual shall provide operating instructions, maintenance manuals, spare parts listing, copies of warranties, wiring diagrams, inspection procedures and shop drawings on all equipment and systems.
- C. Each manual shall be bound in a heavy-duty, 3 inch; three-ring vinyl covered binder with pocket folders for drawings and folded sheet information. Each binder shall be identified on both the front and the spine.

3.04 TRAINING

- A. Upon completion of the on-site testing the manufacturer shall provide the following:

1. Operation and maintenance manuals. Submit operation and maintenance manuals two (2) weeks prior to on-site operating training.
- B. Four hours of on-site operation training during which all routine operation, testing and maintenance procedures are explained. (Operation and maintenance manuals shall be available to Owner's staff during training).

END OF SECTION 26 02 50

SECTION 26 04 50-GROUNDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide material, equipment, labor, and supervision as required for the complete installation of grounding conductors and fittings.

1.03 CODES AND STANDARDS

- A. Except where otherwise required, the following codes shall govern:
 - 1. NEC, Article 250
 - 2. NEC, Article 517 (for Health Care Facilities only)
 - 3. NFPA 101
 - 4. UL 467 – Grounding and Bonding Equipment

PART 2 PRODUCTS

2.01 GENERAL

- A. Service ground conductors and grounding conductors installed below slab on grade shall be bare stranded copper.
- B. All other grounding conductors shall be copper with Type TW, THW or THWN green insulation.
- C. Ground rods shall be "Copperweld" as manufactured by the following and shall be of the sizes indicated on the drawings.
 - 1. Joslyn
 - 2. Erico, Inc
 - 3. Copperweld, Inc
 - 4. O-Z Gedney
 - 5. Thomas & Betts

PART 3 EXECUTION

3.01 INSTALLATION

- A. Metallic conduit system shall be electrically continuous throughout.
- B. All motors and metal frames of all electrical equipment shall be grounded.
- C. System neutral conductor shall be identified throughout the building.
- D. All cord connected electrical equipment frames shall be grounded to the conduit system through a grounding conductor in the cord.
- E. Each feeder shall be provided with a separate green insulated equipment grounding conductor. The required equipment grounding conductor shall be sized as shown on the drawings and shall not be smaller than shown in NEC Table 250.122 and shall be installed in a common conduit with the related phase and/or neutral conductors. In the case of parallel feeders, each raceway shall have a full size green insulated equipment ground conductor.
- F. A single green insulated equipment grounding conductor may be run with multiple phase conductor groups in a common raceway which serve wiring devices with shared neutrals and multipole breakers in compliance with NEC Article 210.4. The required equipment grounding conductor shall be sized as shown on the drawings and shall not be smaller than shown in NEC Table 250.122 and shall be installed in a common conduit with the related phase and/or neutral conductors.

- G. Single phase branch circuits required for 120 volt and 277 volt lighting, receptacles, and motors shall consist of phase, neutral and grounding conductors installed in a common metallic conduit.
 - 1. Flexible metallic conduit equipment connections utilized in conjunction with the above single-phase branch circuits shall be provided with suitable green insulated equipment grounding conductors connected to approved grounding terminals at each end of the flexible conduit.
 - 2. Single phase branch circuits installed in non-metallic conduits shall be provided with a separate green insulated grounding conductor as hereinbefore specified.
- H. For Health Care Facilities, in areas used for invasive procedures (operating Rooms, C-Section Rooms, etc.), all non-current carrying conductive surfaces of fixed electrical equipment shall be grounded by an insulated copper conductor, sized in accordance with Table 250.66.
- I. For Health Care Facilities, in patient-care areas are served by more than one distribution power panel, the reference ground buses in the panels shall be bonded together by a No. 10 insulated copper conductor.
- J. Furnish and install driven ground rods and grounding conductors as indicated on the drawings.
- K. All concealed connections shall be welded with "Cadweld" (or equal by "Thermoweld") fittings. Exposed connections shall be bolted to equipment bus using compression type lugs.
- L. Furnish and install all required grounding conductors and fittings as delineated in National Electric Code Article 250.

END OF SECTION 26 04 50

SECTION 26 05 01- LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Provide lighting fixtures, accessories, labor, and supervision necessary to install a complete Lighting System as required by the Drawings and this Section.

1.03 CODES AND STANDARDS

- A. Except where otherwise required by this Section, the following Standards and Codes shall govern:
 1. NEC, Article 410
 2. IESNA
 3. UL Listed

1.04 SUBMITTALS

- A. Submit catalog cuts giving complete description of fixtures to include photometric curves and data, dimensions, features, accessories, and method of installation. All cuts shall be submitted at one time, bound in separate sets having 1 cut of each fixture in each set.
 1. A complete description (ratings, manufacturer and catalog number) of the ballast contained within each compact fluorescent, fluorescent and HID fixture shall be included with the fixture submittals.

1.05 QUALIFICATION

- A. Lighting fixtures shall be furnished as scheduled on drawings.

PART 2 PRODUCTS

2.01 FLUORESCENT FIXTURES

- A. Fluorescent fixture housings shall be die formed of cold rolled steel of not less than 20 gauge. Construction shall provide an approved method of locking the lens or shielding in place. Enamel finish for light reflectance shall have a hardness between H and 3H. Before enamel is applied, the metal shall be cleaned and prepared by "Bonderizing" or an equivalent process.
- B. Plastic lenses for fluorescent fixtures shall be 100% virgin acrylic, non-hogged type, not less than .125" overall thickness with a minimum lens weight of 8.0 ounces per square foot.
- C. Temperature around ballast and in fixture housing shall not exceed 90°C with ambient room temperature of 27°C.
- D. Unless specifically scheduled otherwise on Drawings, all fluorescent ballasts shall be electronic programmed rapid start ballasts shall be non-hybrid high frequency type. Ballasts shall be Advance "Optanium" series, Sylvania "Quicktronic Prostart" Series, Universal Lighting Technologies "AccuStart" Series, or GE "Ultrastart" Series with the following minimum features:
 1. All electronic rapid start design with class P thermal protection.
 2. Total harmonic contribution less than 10%.
 3. Unless a specific ballast voltage is specified, ballast shall automatically detect and operate from a voltage range of 120V thru 277V +/- 10% with no damage to the ballast.
 4. Programmed soft start.
 5. Parallel operation of lamps.

6. T5 and compact fluorescent lamps shall have integral end of lamp life ballast protection.
 7. Five year warranty.
 8. Maintain lamp filaments at full temperature.
 9. Crest factor less than 1.7.
 10. Ballast factor greater than 85%.
 11. Class A sound rating.
- E. Magnetic fluorescent ballasts, where scheduled on the drawings, shall be Advance Mark III Energy Saving Type, or equivalent by SLI Lighting (Valmont) or Universal Lighting Technologies, Inc. (Magnetek).
 - F. Fluorescent dimming ballasts for two wire medium bipin lamp sockets shall be full range type (1%-100%). Lutron Type FDB or HL3.
 - G. Ballasts for remote mounting shall be furnished with NEMA 1 enclosures.
 - H. Recessed fixtures in plaster ceilings shall be furnished with plaster frames.
 - I. Prior to placing orders for recessed fluorescent fixtures, verify the types of ceilings and suspension systems that have been approved for the project and order fixtures with accessories as required to fit in the approved ceilings.
 - J. Cove lighting shall consist of staggered strip style fluorescent fixtures. Fixture units shall be one or two lamp as specified in the fixture schedule and field assembled by use of fixtures that are nominal 24" and 48" lamp units.

2.02 INCANDESCENT FIXTURES

- A. Glassware for fixtures shall be high quality with not less than 65% efficiency in light transmission.
- B. Recessed fixtures shall be furnished with gaskets, so designed and installed that they will completely eliminate light leakage between flanges and ceilings.
- C. Fixtures shall be furnished with integral thermal overload protection and be so identified as thermally protected.

2.03 METAL HALIDE FIXTURES

- A. Open type metal halide fixtures specified for use with B, BD, BT, ED, ET or R style lamp bases shall utilize medium base EX26 and mogul base EX39 sockets which will only accept ANSI type-O (OPEN) metal halide lamps.
- B. Open type metal halide fixtures specified for use with PAR type lamps shall utilize standard medium and mogul base sockets.
- C. Enclosed type metal halide fixtures can be equipped with type-E, type-S or type-O lamps.
- D. All metal halide fixtures located in indoor sporting areas, multi-purpose rooms, and other indoor areas subject to physical damage, shall contain glass or plastic U.V. attenuating lenses.

2.04 LED FIXTURES

- A. General:
 1. Luminaire manufacturer shall have a minimum of five (5) years' experience in the manufacture and design of LED products and systems and no less than one hundred (100) North American installations.
 2. Unless otherwise specified, all LED luminaires and power/data supplies shall be provided by a single manufacturer to ensure compatibility.

3. All components, peripheral devices and control software are to be provided by and shall be the responsibility of a single entity. All components shall perform successfully as a complete system.
4. Include all components necessary for a complete installation. Provide all power supplies, synchronizers, data cables, and data terminators for a complete working system.
5. All LED sources used in the LED luminaire shall be of proven quality from established and reputable LED manufacturers and shall have been fabricated after 2007.

B. Warranty:

1. System shall carry a full warranty for five (5) years. Manufacturer shall be responsible for cost of shipping and labor to replace any component of the system that fails within 2 years of installation.

C. Products and Components – Performance

1. LED luminaires and components shall be UL listed or UL classified.
2. All LED components shall be Restriction of Hazardous Substance Directive (RoHS) compliant.
3. LED luminaires shall be tested by a certified testing agency and shall comply with IESNA LM-79 approved method for electrical and photometric measurement of solid-state lighting products.
4. LEDs shall comply with ANSI/NEMA/ANSI C78.377-2008 – Specifications for the Chromaticity of Solid-State Lighting Products. Color shall remain stable throughout the life of the lamp.
5. LEDs shall comply with IESNA LM-80 and TM-21 – Standards for Lumen Maintenance of LED Lighting Products
6. White LEDs shall have a rated source life of 50,000 hours under normal operating conditions. RGB LEDs shall have a rated source life of 100,000 hours. LED "rated source life" is defined as the time when a minimum of 70% of initial lumen output remains.
7. Luminaire assembly shall include a method of dissipating heat so as to not degrade life of source, electronic equipment, or lenses. LED luminaire housing shall be designed to transfer heat from the LED board to the outside environment. Luminaire housing shall have no negative impact on life of components.
8. LEDs shall be adequately protected from moisture or dust in interior applications.
9. For wet and damp use, LED-based luminaires itself shall be sealed, rated, and tested for appropriate environmental conditions, not accomplished by using an additional housing or enclosure. Such protection shall have no negative impact on rated life of source or components, or if so, such reductions shall be explicitly brought to the attention of the designer. Such luminaires shall be marked "Suitable for Wet Locations" and "Suitable for Damp Locations", respectively, in accordance with Article 410 of the NEC.
10. For corrosive environments, LED-based luminaires itself shall be sealed, rated, and tested for appropriate environmental conditions, not accomplished by using an additional housing or enclosure. Such protection shall have no negative impact on rated life of source or components, or if so, such reductions shall be explicitly brought to the attention of the designer. Such luminaires shall be marked "Corrosion Resistant" or "Vapor-tight", in accordance with Article 410 of the NEC.

11. All hardwired connections to LED luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
12. The LED luminaire shall be operated at constant and regulated current levels. LEDs shall not be overdriven beyond their specified nominal voltage and current.
13. RGB LED luminaires shall utilize an equal combination of high brightness red, blue and green LEDs, unless otherwise noted, to provide up to 16.7 million additive RGB colors and shall be capable of at least 8-bit control.
14. Power / data supply shall have the following:
 - a. Supply shall be internally fused for overload and short circuit protection.
 - b. Supply outputs shall have current limiting protection.
 - c. Supply shall provide miswiring protection.
 - d. Supply shall have power factor correction.
 - e. Supply shall provide connections that are conduit-ready or clamp-style connections in the case of low-voltage wiring.
 - f. Supply shall be UL listed for Class 1 or Class 2 wiring

2.05 LAMPS

- A. All fluorescent lamps shall be 80 CRI (minimum), low-mercury type ("Green Tip") designed to pass the Federal TCLP criteria for classification as non-hazardous waste. Comply with EPA's Toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL Standards.
- B. All metal halide lamps that are installed in an open fixture shall be classified as ANSI Type-O with a shrouded arc-tube or thick-glass parabolic reflector (PAR) for protection.
- C. Lamps shall be General Electric, Osram/Sylvania, or Philips Lighting.
- D. The Electrical Contractor shall furnish lamps for all fixtures per the schedule on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install fixtures as indicated on the Drawings. Verify exact locations from architectural reflected ceiling plans.
 1. Fixtures shall be supported in accordance with Article 410 of the NEC.
 2. All fixture supports shall be capable of supporting the fixture in question plus 100% additional weight.
 3. Fixtures shall not be supported from ductwork or other system components.
- B. Provide all mounting hardware, plates, and accessories necessary for a complete installation of all fixtures. Coordinate with various ceiling types.
- C. Recessed fixtures in removable ceilings shall be connected to the branch circuit with flexible conduit and branch circuit wire from an accessible junction box. Where fluorescent fixture housings are connected together, use 90°C wire for branch circuit feed through fixture channels.
- D. From an accessible approved raceway, outlet or junction box located above a suspended ceiling to recessed or surface lighting fixtures, furnish and install minimum 3/8" flexible metallic conduit at least 4 feet and not more than 6 feet in length. The outlet or junction box shall be located a minimum of 1 foot and not more than 4 feet from the fixture. Minimum size #16 AWG phase and neutral conductors shall be installed in the flexible conduit to the fixture with installation as specified below.

- E. Fixtures shall be grounded to the conduit system either through the hanging device or by means of a #14 green jumper. Lamp sockets shall be wired so that the outer shell is connected to the neutral grounded conductor.
- F. Fixtures recessed in furred ceiling shall be installed so that they can be removed from below the ceiling.
- G. Fixtures installed in plastered or acoustical tile shall not be supported directly from the ceiling. Support fixtures from metal bar hangers or Unistrut channels attached to the ceiling supports.
- H. Fixtures installed in lay-in, exposed tee, grid ceilings shall be laid in and provided with hold-down "hurricane" clips (sheet metal screws through the fixture housing are not acceptable, without exception). It is the responsibility of the Electrical Contractor to provide sufficient ceiling hangers to support the weight of the lighting fixtures and associated wiring.
- I. Suspended fixtures shall be supported from building structure. Do not use ceiling grid to support suspended fixtures.
- J. Cove fixture installations shall be installed to provide an even illumination of the adjacent wall and ceiling. The overall light length shall extend to within two inches of each end of the coved area. The Electrical Contractor shall be responsible for verifying final field measurements and install fixtures accordingly.
- K. Where continuous runs of fixtures exist, laser sight to ensure fixtures are installed straight and true. All seams/joints between individual fixtures in the run shall be tightly fitted to avoid light leaks.

END OF SECTION 26 05 01

SECTION 26 09 32-AUTOMATIC LIGHTING CONTROLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 SCOPE

- A. Provide material, equipment, labor, and supervision as required for the complete installation of lighting controls as required by the Drawings and this Specification.
- B. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- C. It shall be the contractor's responsibility to make all proper adjustments to assure Owner's satisfaction with the occupancy system.

1.03 CODES AND STANDARDS

- A. Lighting controls and relays shall be UL 508 listed and marked.
- B. UL-924 Standard for Emergency Lighting and Power Equipment
- C. Applicable local energy codes.
- D. NFPA 70

1.04 QUALIFICATIONS

- A. Occupancy sensors shall be as manufactured Hubbell, Leviton, Sensor Switch, or Wattstopper.
- B. Low voltage controls system wiring shown on plans is based on Acuity Nlight equipment. It is the Electrical Contractor's responsibility to verify that the wiring shown in the drawings is adequate for the system to be furnished. Any additional cabling, conduit, equipment, or devices required for a complete installation shall be provided as part of the base bid.

1.05 SUBMITTALS

- A. Submittal data shall consist of shop drawings incorporating required technical data and dimensions.

PART 2 PRODUCTS

2.01 GENERAL

- A. Contractors, relays and time switches shall be as described on drawings.

2.02 WALL SWITCH LINE VOLTAGE OCCUPANCY SENSORS

- A. Single wall switch with integral passive infrared sensor (PIR) technology shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
 - 1. Hubbell #LHIRS1 Series.
 - 2. Leviton #ODS15-ID Series.
 - 3. Philips #LRS2210 Series.
 - 4. Sensor Switch #WSX Series.
 - 5. Wattstopper #PW-100 Series.
- B. Single wall switch with integral passive infrared sensor (PIR) technology and LED nightlight shall be 120 or 277 volt type, as required per Drawings, with 180 degree coverage.
 - 1. Hubbell #LHN-IRS Series.
 - 2. Leviton #OSSNL-ID Series.
 - 3. Philips #LRS2230 Series.

4. Sensor Switch #WSX-NL Series.
 5. Wattstopper #PW-103N Series.
- C. Dual wall switch with integral passive infrared sensor (PIR) technology and LED nightlight shall be 120 or 277 volt type, as required per Drawings, with 180 degree coverage.
1. Hubbell (not available).
 2. Leviton (not available).
 3. Philips (not available).
 4. Sensor Switch #WSX-2P-NL Series.
 5. Wattstopper #CS-350-N Series.
- D. Single wall switch with integral dual technology sensor (PIR and ultrasonic) shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
1. Hubbell #LHMTS1 Series.
 2. Leviton #OSSMT-MD Series.
 3. Philips #LRS2220 Series.
 4. Sensor Switch #WSX-PDT Series.
 5. Wattstopper #DW-100 Series.
- E. Dual wall switch with integral dual technology sensor (PIR and ultrasonic) shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
1. Hubbell #LHMTD2 Series.
 2. Leviton #OSSMD-MT Series.
 3. Philips #LRS2225 Series.
 4. Sensor Switch #WSX-PDT-2P Series.
 5. Wattstopper #DW-200 Series.
- F. Single wall switch with integral passive infrared sensor (PIR) technology with 0-10V dimming capabilities shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
1. Hubbell #LHD-IRS Series.
 2. Leviton (not available).
 3. Philips (not available).
 4. Sensor Switch #WSX-D Series.
 5. Wattstopper #PW-311 Series.
- G. Single wall switch with integral dual technology sensor (PIR and ultrasonic) with 0-10V dimming capabilities shall be universal line voltage type with adaptive learning technology and 180 degree coverage.
1. Hubbell (not available).
 2. Leviton (not available).
 3. Philips (not available).
 4. Sensor Switch #WSX-PDT-D Series.
 5. Wattstopper #DW-311 Series.

2.03 CORNER MOUNTED LINE VOLTAGE OCCUPANCY SENSORS

- A. Wall and ceiling mounted passive infrared sensors (PIR only) technology sensors shall be low voltage type with adaptive learning technology, 90 degree coverage, isolated relay for use by BAS system and integral light level sensor.
 - 1. Hubbell #LOIRWVRP Series.
 - 2. Leviton #OSWWV-IOW Series.
 - 3. Philips #LRM2270 Series.
 - 4. Sensor Switch #WV-16-R-P Series.
 - 5. Wattstopper #CX-100 Series.

2.04 CEILING MOUNTED LINE VOLTAGE OCCUPANCY SENSORS

- A. Ceiling mounted passive infrared sensors (PIR only) technology sensors shall be low voltage type with adaptive learning technology, 360 degree coverage area of 1000 square feet minimum, isolated relay for use by BAS system and integral light level sensor.
 - 1. Hubbell #OMNIIRP Series.
 - 2. Leviton #OSC15-IOW Series.
 - 3. Philips #LRM2250 Series.
 - 4. Sensor Switch #CM-10-R-P Series.
 - 5. Wattstopper #CI-300 Series.
- B. Ceiling mounted dual technology sensors (PIR and ultrasonic) shall be low voltage type with adaptive learning technology, 360 degree coverage area of 1000 square feet minimum, isolated relay for use by BAS system, and integral light level sensor.
 - 1. Hubbell #OMNIDTRP Series.
 - 2. Leviton #OSC10-M.
 - 3. Philips #LRM2255 Series.
 - 4. Sensor Switch #CM-PDT-9-R-P Series.
 - 5. Wattstopper #DT-300 Series.

2.05 DAYLIGHT SENSORS

- A. Ceiling mounted daylight sensors with automatic on/off switching, adjustable foot-candle set point, adjustable dead-band set point, and white finish.
 - 1. Hubbell (not available).
 - 2. Leviton #PCC1S Series.
 - 3. Philips #LRL2380 Series.
 - 4. Sensor Switch #CM-PC Series.
 - 5. Wattstopper #LS-102 Series.
- B. Ceiling mounted daylight sensor with automatic 0-10V dimming capabilities, adjustable foot-candle set point, and white finish.
 - 1. Hubbell #DLC7 Series.
 - 2. Leviton #ODCOP-D0W Series.
 - 3. Philips #LRL1222 Series.
 - 4. Sensor Switch #CM-ADC Series.
 - 5. Wattstopper #LS-301 Series.

2.06 DIGITAL TIME SWITCH

- A. Wall mounted digital time switches shall be universal 120/277V type with on/off push button, adjustable digital timer, visual flash warning and capable of three way control.
 - 1. Hubbell #TD300 Series.
 - 2. Leviton (not available).
 - 3. Philips #LTA24550C Series.
 - 4. Sensor Switch #PTS Series.
 - 5. Wattstopper #TS-400 Series.

2.07 ACCESSORIES

- A. Relay/power packs shall be furnished with universal 120/277V input, 24 VDC output, and 20 amp, 277 volt switching contact.
 - 1. Hubbell #UVPP Series.
 - 2. Leviton #002-OSP20-RD0 Series.
 - 3. Philips #LCA Series.
 - 4. Sensor Switch #PP20 Series.
 - 5. Wattstopper #BZ-50 Series.
- B. Slave power packs (relay only) shall be furnished with 24 VDC coil input and 5 amp, 277 volt switching contact.
 - 1. Hubbell #RRU Series.
 - 2. Leviton #OSA20 Series.
 - 3. Philips #LCA Series.
 - 4. Sensor Switch #SP20 Series.
 - 5. Wattstopper #A277C-P Series.

2.08 Low Voltage Lighting Control Systems

- A. Wall mounted low voltage 2-button (on, off controls) lighting control station with low voltage networking capabilities.
 - 1. Acuity NLight #NPODM Series.
 - 2. Hubbell #NXSW-OO Series.
 - 3. Wattstopper #LMSW-101 Series.
- B. Wall mounted two zone low voltage 4-button (on/off controls) with low voltage networking capabilities.
 - 1. Acuity NLight #NPODM-2P Series.
 - 2. Hubbell #NXSW-4 Series.
 - 3. Wattstopper #LMSW-104 Series.
- C. Wall mounted low voltage 3-button (on/off, raise, lower control) with low voltage networking capabilities.
 - 1. Acuity NLight #NPODM-DX Series.
 - 2. Hubbell #NXSW-ORLO Series.
 - 3. Wattstopper #LMSW-103 Series.
- D. Wall mounted touchscreen room control with scene controls, individual zone controls, pin code lockout with low voltage networking capabilities.
 - 1. Acuity NLight #NPOD-GFX Series.

2. Hubbell #NXSW-TH3 Series.
 3. Wattstopper #EQ40TB Series.
- E. Surface ceiling mounted dual technology (PIR/microphonics) occupancy sensor with 360 degree coverage of 1000 square feet minimum, light sensor, isolated relay for use by BAS, and low voltage networking capabilities.
1. Acuity NLight #NCM-PDT-10 Series.
 2. Hubbell #NXOS-OM-DT-1-R Series.
 3. Wattstopper #LMDC-100-LMRL-100 Series.
- F. Wall and ceiling mounted dual technology (PIR/microphonics) occupancy sensor with 120 degree coverage of 70 feet, mounting bracket, and low voltage networking capabilities.
1. Acuity NLight #NWV-PDT-16 Series.
 2. Hubbell #OS-LODT-R Series.
 3. Wattstopper #LMDX-100 Series.
- G. Surface ceiling mounted single zone daylight harvesting photocell sensor with dimming controls, adjustable setting pushbuttons, and low voltage networking capabilities.
1. Acuity NLight #NCM-ADCX Series.
 2. Hubbell #NXDS Series.
 3. Wattstopper #LMLS-400 Series.
- H. Relay power pack with 16A relay, 120/277V universal input, and low voltage networking capabilities.
1. Acuity NLight #NPP16 Series.
 2. Hubbell # NXRC-1R-UNV Series.
 3. Wattstopper #LMRC-100 Series.
- I. Dimming relay power pack with 16A relay, 120/277V universal input, 0-10V dimming, and low voltage networking capabilities.
1. Acuity NLight #NPP16-D Series.
 2. Hubbell # NXRC-1RD-UNV Series.
 3. Wattstopper #LMRC-211 Series.
- J. Emergency transfer dimming relay power pack with 16A relay, 120/277V universal input, 0-10V dimming, UL924 emergency operation, unswitched voltage sensing terminal, and low voltage networking capabilities.
1. Acuity NLight #NPP16-D-ER Series.
 2. Hubbell # NXRC-1RD-UNV-UL924EPC1-D Series.
 3. Wattstopper #LMRC-211-ELCU-200 Series.
- K. Standalone BAS interface relay power pack with low voltage relay and low voltage networking capabilities.
1. Acuity NLight #NAR40 Series.
 2. Hubbell #NXCI Series.
 3. Wattstopper #LMRL Series.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install switching devices, low voltage controls, and interconnecting wiring as indicated on the Drawings and as required for complete system operation.

- B. All terminations shall be as per the manufacturer's approved shop drawing and recommendations.
- C. Provide all required mounting accessories.
- D. Make all power and control connections.
- E. The electrical contractor shall be responsible for programming the system and device settings for proper system operations.
- F. All programming required for proper system operation and as required by the Architect, Engineer, and Owner shall be the responsibility of the Electrical Contractor.
- G. Two hour (min) tutorial of the system operation and programming shall be provided by the manufacturer for the Maintenance Staff.
- H. Program graphic stations as directed by the Owner.
- I. Make final sensor adjustments after sensor installation for optimal performance.
 - 1. Daylight sensors in corridors shall be set for 15 FC with 50% dead band and 10 minute off delay, unless noted otherwise.
 - 2. Occupancy sensors shall be set for a 20 minute auto-off manual-on operation where applicable.
 - 3. Occupancy sensors with integral light sensors shall be set for 15 FC (150 Lux), unless noted otherwise.
- J. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Locate sensor at the minimum distance from HVAC diffusers as directed by the manufacturer. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The Electrical Contractor shall locate sensors to properly and completely cover the respective room.
- K. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.
- L. Upon completion of the installation, the system shall be completely commissioned by the Electrical Contractor, who will verify all adjustment and sensor placement to ensure a trouble-free occupancy-based lighting control system.

END OF SECTION 26 09 32

SECTION 26 09 50-ELECTRICAL BID ALTERNATES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. Furnish materials, labor, and supervision necessary for the bid alternates as described.
- B. Refer to Contractor's Bid Form for further details of bid alternates.

1.03 DESCRIPTION

- A. Add Alternate #E1: State the amount to be added to the Base Bid for all labor and materials associated with the installation of the vandal-resistant bollards shown on the Electrical Site Plan E.001.
 - 1. New underground raceways and branch circuit wiring.
 - 2. Utilization of existing lighting contactor for controls.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION - (NOT USED)

END OF SECTION 26 09 50

SECTION 26 36 00-MANUAL TRANSFER SWITCHES

PART 1 GENERAL

1.01 SCOPE

- A. Contractor shall furnish, deliver, install and test the manual transfer switches as specified herein and in accordance with the drawings.

1.02 QUALIFICATIONS

- A. Manual transfer switches and associated accessories shall be by one of the following manufacturers:
 - 1. ESL Power Systems, Inc.
 - 2. Lake Shore Electric

1.03 QUALITY ASSURANCE

- A. Manual transfer switch shall be UL listed and labeled under the UL 1008 standard.
- B. Manual transfer switch manufacturer shall provide a complete factory assembled, wired and tested manual transfer switch.
- C. Manual transfer switch shall be factory Hi-pot tested for a period of not less than 60 seconds.
- D. Manual transfer switch installation shall meet all applicable NEC standards.

1.04 SUBMITTALS

- A. Contractor shall submit manufacturer's drawings and data of manual transfer switches for Engineer's approval prior to start of fabrication. Drawings and data shall include, as a minimum, dimensioned general arrangement drawings and wiring diagrams, UL listing information including UL control or file number, short circuit rating or withstand rating, component data, mounting provisions, conduit entry locations and installation instructions.
- B. Upon installation of manual transfer switches Contractor shall submit manufacturer's Operating & Maintenance Manual which shall include as a minimum:
 - 1. Certified as-built General Arrangement drawings and Wiring Diagram.
 - 2. Materials / Component List including part numbers.
 - 3. Maintenance and service requirements.
 - 4. Certificate of Compliance and hi-pot test data.

1.05 WARRANTY

- A. Manual transfer switches shall be covered by manufacturer's warranty for a minimum period of (1) one year after shipment from manufacturer.

PART 2 PRODUCTS

2.01 GENERAL

- A. All equipment shall be new.
- B. Manual transfer switch manufacturer must have produced and sold UL 1008 Listed manual transfer switches as a standard product for a minimum of (3) years.
- C. Manual transfer switches shall be molded case circuit breaker type; knife switch or fused switches are not acceptable.
- D. Contractor shall be responsible for the equipment until it has been installed and is finally inspected, tested and accepted in accordance with the requirements of this Specification.

2.02 MANUAL TRANSFER SWITCHES

- A. Manual transfer switch shall consist of (2) two mechanically-interlocked molded case circuit breakers, cam-style male connectors, power distribution block, 120V heater, and grounding terminals, all housed within a padlockable enclosure.
- B. Manual transfer switch enclosure shall be wall-mounting NEMA Type 3R, constructed of continuous seam-welded, powder coated galvanized, annealed steel.
 - 1. The main access shall be through an interlocked, hinged door that extends the full height of the enclosure.
 - 2. Access for portable generator cables with female cam-style plugs shall be via drawn flange cable entry openings in the bottom of enclosure for wall mount units.
 - 3. A hinged flap door shall be provided to cover the cable openings when cables are not connected; the hinged flap door shall allow cable entry only after the main access door has been opened.
 - 4. Enclosure shall be powder coated after fabrication; color shall be ANSI #61 gray.
- C. Cam-style male connectors (inlets) shall be UL Listed single-pole separable type and rated 400 amps at 600VAC.
 - 1. Cam-style male connectors shall be color coded.
 - 2. Cam-style male connectors shall be provided for each phase and for ground, and shall also be provided for neutral if required.
 - 3. Each of the phase cam-style male connectors within the enclosure shall be factory-wired to a molded case circuit breaker.
 - 4. The ground cam-style male connectors shall be bonded to the enclosure, and a ground lug shall be provided for connection of the facility ground conductor.
 - 5. The neutral cam-style male connectors, if required, shall be factory wired to a power distribution block.
- D. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the molded case circuit breakers.
- E. Molded case circuit breakers shall be UL Listed and the short circuit interrupt rating shall be a minimum of 22kAIC at 208VAC.
 - 1. Each circuit breaker shall be 3-pole, 100 amp rated.
 - 2. One molded case circuit breaker shall be fed from permanent generator power; the other molded case circuit breaker shall be fed from the cam-style male connectors to supply power from a portable generator.
 - 3. Both molded case circuit breakers shall include UL Listed door-mounted operating mechanisms, preventing the opening of the main access door unless both breakers are in the "OFF" position.
 - 4. Both molded case circuit breakers shall be mounted behind a deadfront panel.
 - 5. The (2) molded case circuit breakers shall be safety interlocked by mechanical means to ensure that only one breaker can be closed at any given time.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prior to installation of manual transfer switches, Contractor shall examine the areas and conditions under which the manual transfer switch is to be installed and notify the Engineer in writing if unsatisfactory conditions exist.

- B. Manual transfer switch shall be installed as shown on the drawings and per the manufacturer's written instructions. In addition, the installation shall meet the requirements of local codes, the National Electrical Code and National Electrical Contractors Association's "Standard of Installation".
- C. Conduit entry into the manual transfer switch shall be by Contractor; Contractor shall furnish and install listed watertight conduit hubs, as manufactured by MYERS or T&B, for each conduit entry on the manual transfer switch.
 - 1. The incoming hub size shall match the conduit size for feeders and ground as shown on the drawings.
 - 2. The outgoing hub size shall match the conduit size for loads and ground as shown on the drawings.
 - 3. Hubs shall be properly installed and tightened to maintain Type 3R integrity of the manual transfer switch enclosure.
- D. Any conduit penetrations that are above live parts must be properly sealed to prevent moisture intrusion from the conduit.
 - 1. A UL Listed or Classified expanding foam sealant (such as Rainbow Quick Seal 79547), or other sealing product meeting local codes and NEC requirements should be used to seal the interior of the conduit around the cables.
 - 2. The product selected must be able to permanently seal around all wires and the conduit (common "Duct Seal" is not acceptable for this application).
 - 3. The sealing shall be done at the entry into the enclosure so the seal can be verified and inspected from inside the enclosure. Failure to seal may allow water to drip on live parts and will void warranty.
- E. Contractor shall terminate feeder conductors, load conductors and ground per the manufacturer's instructions. All field wiring terminations shall be torqued as required per the instructions on the manual transfer switch's power distribution block, circuit breaker & ground lug.

3.02 FIELD TESTING

- A. Prior to energizing manual transfer switch, the Contractor shall perform the following checks and tests as a minimum:
- B. Verify mounting and connections are complete and secure.
- C. Verify internal components and wiring are secure.
- D. Perform continuity check of all circuits.
- E. Perform 1,000 VDC megger test on feeder, load and ground cables.
- F. Verify deadfront is secure.
- G. With the manual transfer switch deadfront in place and the main access door closed and properly latched, actuate both Operator Mechanisms; verify only (1) breaker at a time can be turned to the "ON" position.
- H. Confirm operation of the manual transfer switch ground receptacle by attaching a plug to the manual transfer switch ground receptacle and then verify that the plug is grounded to the facility ground.
- I. Once utility power has been applied, confirm operation of manual transfer switch by following directions on main access door.

END OF SECTION 26 36 00

SECTION 28 00 51-BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Related and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The following Division 26 sections also apply to the work of this Division:
 - 26 00 52 - Tests
 - 26 00 53 - General Wiring
 - 26 00 54 - Cutting and Patching
 - 26 00 55 - Temporary Power
 - 26 00 56 - Firestopping
 - 26 00 60 - Excavating, Trenching, Backfilling and Restoration
 - 26 00 74 - Electrical Demolition and Salvage
 - 26 01 11 - Conduit Systems
 - 26 01 20 - Wire and Cable
 - 26 01 25 - Pulling Cables
 - 26 01 52 - Wiring of Equipment Furnished Under Other Divisions
 - 26 04 50 - Grounding

1.02 SCOPE

- A. The work shall include the furnishing of systems, equipment and materials specified in this Division and as called for on the Drawings, to include: supervision, operations, methods and labor for the fabrication, installation, start-up and tests for the complete electrical installation.
- B. Drawings for the work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangement and locations of the work. Because of the scale of the Drawings, certain basic items such as conduit fittings, access panels, sleeves, pull and junction boxes may not be shown. Where such items are required by Code or by other Sections, or where they are required for proper installation of the work, such items shall be included.
- C. Equipment Specification may not deal individually with minute items such as components, parts, controls and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for.

1.03 ELECTRICAL REFERENCE SYMBOLS

- A. Symbols used on the floor plans are defined in the Electrical Symbols Schedule on the Drawings. Not necessarily will all symbols scheduled be required for the project.
- B. The symbols used for schematic or one line power and control wiring diagrams are American Standard Graphical Electrical Symbols and are published in American Standard Chart Z32.3.

1.04 PERMITS, INSPECTIONS AND CODES

- A. The Contractor shall secure and pay for all permits and inspections required by the governing authorities for the prosecution of the electrical work of this division. All permits and certificates of inspection and approval signed by the controlling building department shall become the property of the Owner.
- B. All wiring shall be in compliance with the current edition of the National Electric Code, applicable State and City regulations and OSHA. In cases of conflict between Code and Specifications, the more restrictive requirements shall govern.

1.05 VISIT TO THE SITE

- A. The Electrical Contractor shall be required to visit the site of the work and familiarize himself with all such conditions affecting the work. The submission of his bid proposal shall presuppose his knowledge of all such conditions.

1.06 WORKMANSHIP

- A. Employ only experienced craftsmen under direct supervision of a full time competent foreman.
- B. Keep fully informed as to progress of work, so that work of this Division may be built into place in sufficient time to insure against delay to other trades, and to prevent misalignments or damage to electrical work.

1.07 COORDINATION, CONDUCT AND SCHEDULING OF WORK

- A. Electrical drawings are diagrammatic, indicating general arrangement, approximate sizes, general locations of equipment and outlets. Verify dimensions in field; adjust to manufacturer's shop drawings. Do not scale drawings.
- B. Architectural and structural drawings supersede electrical drawings. Determine that work of this Division can be accommodated within spaces provided. Notify Construction Manager and/or Architect of any interferences before starting installation.
- C. Determine sizes, locations for chases, openings necessary for installation of electrical work; cooperate with other trades in setting of sleeves, inserts and hangers.
- D. Coordinate this work with all trades, serving utilities and equipment suppliers. Arrange operation, submittal approvals and equipment delivery, so as not to delay installation or completion of any parts of interrelated work so that construction may proceed on schedule.
- E. Cooperate with Mechanical trades in preparing interference drawings for points where there is possible conflict between trades. Exact locations of pipes, ducts, conduit based on field measurements with final arrangement to be determined by intra-trade agreements subject to Construction Manager's and/or Architect's review.
- F. Architect reserves the right to make reasonable changes in indicated locations without extra cost to the Owner.
- G. Drawings other than electrical drawings, and other sections of this Specification, may show or specify electrically operated equipment, wiring diagrams, etc. The Contractor shall examine all such drawings and specification sections and become familiar with the characteristics and required connections for all equipment.
- H. Conduits, wiring and equipment shall be arranged substantially as indicated. Any change resulting in a savings in labor or material shall be made only in accordance with a contract change order. Deviations shall be made only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted to and approved by the Architect.

1.08 MATERIALS

- A. All equipment and devices shall be new and shall conform to NEMA and Underwriters' Laboratories Standards. Where Specifications describe, or plans show, materials or equipment of higher quality than required by code and local ruling, the Drawings and Specifications shall govern the quality of the material or equipment.
- B. Materials and equipment used as extensions to existing special systems shall be of matching electrical characteristics for satisfactory operation of the complete system and shall be of the same manufacture and design unless otherwise approved.
- C. The Contractor shall submit proof, if requested by the Architect, that the materials, appliances, equipment or devices that he furnishes and installs under this contract, meet the requirements of the Underwriters' Laboratories, Inc. and its publications will be referred to hereinafter by the abbreviation UL, with or without additional identifying symbols.
- D. The National Electrical Code (NEC) of the National Fire Protection Association, and Publications and Standards of the organizations listed below are referenced herein by the abbreviations noted in parentheses, with or without additional identifying symbols. Unless otherwise specified, all work shall be manufactured, tested and installed in accordance with such reference standards.
 - 1. American Society for Testing and Materials (ASTM)

2. Underwriters' Laboratories, Inc. (UL)
3. Insulated Power Cable Engineers Association (IPCEA)
4. National Electrical Manufacturers Association (NEMA)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. American National Standards Institute, Inc. (ANSI)
7. National Fire Protection Association (NFPA)

1.09 GUARANTEE

- A. The Electrical Contractor shall guarantee for a period of one year that all work and equipment will remain free from all defects in workmanship and materials, and that it will comply with all the specific requirements of the Specifications and other Contract Documents governing the work.
- B. All work found by the Architect to be defective will be replaced with new work meeting all the requirements of the Contract. The Electrical Contractor will bear all costs of supplying such new work, and installing and finishing same, and will assume all costs for replacing other work damaged by the removal and replacement of any of the work. The Electrical Contractor will bear all costs for freight, drayage and demurrage, and all labor in connection therewith.

1.10 SUBMITTALS

- A. This Contractor shall prepare or obtain from the manufacturer certified shop or erection drawings of the items listed below. After Contractor's review and approval of the proposed submittal, electronic copies of each shall be stamped and submitted to the Architect for approval before proceeding with installation or construction.
- B. Approval drawings shall be submitted for the following items. Acceptable manufacturers shall be as described in the individual specification sections except where specifically noted below:
 1. 28 07 21 – Fire Alarm System
- C. Electronic submittals shall conform to the following requirements:
 1. Electronic submittals shall be in Portable Document Format (.pdf)
 - a. Electronic submittals shall include a transmittal.
 - b. All portions of the electronic submittal shall be bound in a single .pdf file.
 - c. All content of the submittal shall be visible/readable and shall clearly indicate each item to be reviewed. Indicate specific options or accessories on shop drawings by pointing to, checking off, underlining, or other means.
 - d. File shall be named to match submittal contents.
 - e. Submittals shall include a specific notice of any deviation from the Contract Documents.
 2. Electronic submittals shall include a Contractor review stamp that indicates review and approval by the Contractor prior to submission.
 3. Electronic submittals shall be transmitted via an email.
 - a. One submittal per email.
 - b. Email shall clearly contain project name and contents of submittal.
 4. Failure to conform to the requirements above may result in rejection.
 5. The Reviewer shall return the submittals in a format and method appropriate for the Project and the response.

- D. AutoCAD floor plans are available to Vendors and Contractors to assist in generation of shop drawings.
- E. Prior to the signing of the contract the successful bidder shall submit to the Architect a list of manufacturers of the major items of equipment he proposes to furnish and the names of any subcontractors he proposes to employ.

1.11 ENGINEER'S REVIEW

- A. Shop drawings shall be reviewed for general compliance. The Reviewer will make reasonable efforts to detect and correct errors, omissions and inaccuracies but shall not be responsible for failure to detect errors, omissions, or inaccuracies. Failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.
- B. The Engineer shall mark the shop drawings in one of the ways outlined below. See each description for interpretation of Engineers marks and Contractor responsibilities associated with each.
 - 1. APPROVED: The submittal complies with the requirements of the specifications.
 - 2. APPROVED AS NOTED: The submittal generally complies with the requirements of the specifications but some non-critical items which need to be corrected/coordinated are noted. The corrections shall be changed on the shop drawings submitted for inclusion in the Operations and Maintenance Manual. Re-submittal is not required unless noted otherwise.
 - 3. REVISE AND RESUBMIT: The submittal generally complies with the requirements of the specifications but some critical items which need to be corrected/coordinated are noted. The submittal must be revised and resubmitted with all comments addressed.
 - 4. REJECTED: The submittal does not comply with the requirements of the specifications. The submittal must be revised and resubmitted.
- C. Approval of submittal items shall not eliminate the Engineers right to reject those items if defects are discovered prior to final acceptance of the completed work.

1.12 SUBSTITUTION

- A. Bidders desiring to make a substitution for the specified brand or method shall list such proposed substitution. In each case state the difference in price where substitution is offered. If there is no difference in price, so state.
- B. It shall be understood that the proposal submitted shall be based on the different branches of work and materials specified, and that the Owner is entitled to the use of the materials so specified. Substitution sheet shall be signed and dated by the Electrical Contractor and shall be formatted as follows:

BRAND OR MAKE SPECIFIED PROPOSED SUBSTITUTION ADD DEDUCT

1.13 CONCRETE WORK

- A. Concrete bases and pads for electrical equipment identified on the Drawings or as required shall be the responsibility of this Section.
- B. Pads shall be 3" high with chamfered top edges unless otherwise noted on the Drawings. Pad sizes and locations shall be determined by the Electrical Contractor (do not scale from the Drawings).
- C. This Contractor shall furnish all equipment anchor bolts and shall be responsible for their proper installation and accurate location.

1.14 NAMEPLATES AND LABELS

- A. The Electrical Contractor shall furnish and install a system of nameplates designed to identify each piece of equipment, control unit thereon, and major distribution points. The following color scheme shall be used as a guide:
 - 1. For switchboards, panelboards, control centers, all panels and remote control and indicating devices served by "normal" power, use black plastic, laminated, with white engraved letters to identify basic unit name and system, and each sub-system name and use. For equipment served by "emergency" power, use red plastic, laminated, with white engraved letters.
 - 2. For fire alarm system cabinet and panels, use red laminated plastic with white engraved letters.
 - 3. For telephone distribution cabinets and panels, use black plastic with white engraved letters.
 - 4. Size of nameplates shall be made to readily differentiate between, and identify, equipment and usage. Nameplate identifying items that are transferred to emergency power shall carry a nameplate saying "EMERGENCY".
 - 5. Exposed feeder conduits shall be identified as to load fed and voltage (Normal or Emergency) with 1" high black stenciled letters and numerals; conduit shall be marked every 50 feet. This shall include existing spare conduits.
- B. Fasten nameplates to all enclosures by use of stainless steel sheet metal screws.

1.15 CLEANING AND PAINTING

- A. Touch up and repair any damaged factory finishes on equipment and materials furnished. Other painting will be done under the Painting Division of the Specifications.
- B. Remove any rust spots and prime with rust inhibitive paint any metal surfaces of electrical devices not provided with rust inhibitive coatings. Then apply one coat of paint in color as directed by Architect.
- C. Swab interiors of conduits clean and dry before pulling wire. Clean interiors of boxes and cabinets before installing trims and covers.

1.16 TESTS

- A. Systems shall be tested by the Electrical Contractor and placed in proper working order prior to demonstrating systems to Owner.
- B. Perform such tests as required by authorities having jurisdiction over the site.
- C. Perform tests as described in all subsequent sections of this Division and Related Documents.

1.17 DEMONSTRATIONS

- A. Prior to acceptance of the work, the Contractor shall demonstrate to the Owner or his designated representative all features and functions of all systems and shall instruct the Owner in the proper operation of the systems. Each system shall be demonstrated once.
- B. The demonstrations shall consist of not less than the following:
 - 1. Point out the actual location of each component of a system and demonstrate its function and its relationship to other components within the system.
 - 2. Demonstrate the electrical systems by actual "start-stop" operation showing how to work controls, how to reset protective devices, how to replace fuses, and what to do in an emergency.
 - 3. Demonstrate communication, signal, alarm and detection systems by actual operation of the systems and show how to reset signal, alarm and detection devices.
- C. Systems to be demonstrated shall include but not be limited to the following:

1. Alarm Detection and Signal Systems
 2. Communication Systems
- D. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instruction, and shall arrange to have the manufacturer's representatives present to assist with the demonstrations.
- E. Contractor shall coordinate dates and times for performing all demonstrations with the Owner.

1.18 OPERATION AND MAINTENANCE MANUALS

- A. Electrical Contractor shall furnish to the Owner operation/maintenance manuals as described in the Division 1 Specifications.
- B. Manuals shall meet or exceed all Division 1 Specification requirements and shall minimally include three (3) individually bound and indexed (thumb tabbed) manuals. Each manual shall provide operating instructions, maintenance manuals, spare parts listing, copies of warranties, wiring diagrams, inspection procedures and shop drawings on all equipment and systems.
- C. Unless otherwise directed by the Division 1 Specification each manual shall be bound in a heavy-duty, 3 inch, three-ring vinyl covered binder with pocket folders for drawings and folded sheet information. Each binder shall be identified on both the front and the spine.

1.19 AS-BUILT DRAWINGS

- A. As work progresses during the construction period, the Electrical Contractor shall record (on a dedicated set of bid drawings) any deviations from the design drawings. The completed record set of as-built drawings shall be delivered to the Architect prior to the Electrical Contractor's request for final payment.
- B. As-built documentation shall meet or exceed all Division 1 Specification requirements.

1.20 PROJECT CLOSE-OUT

- A. The installing Contractor shall contact the Engineers' office upon completion of the installation to request final inspection. At that time the following documents shall be assembled and provided for review at the job site:
- Photocopies of all signed electrical inspection permits.
 - O & M Manuals (as described above).
 - Photocopies of certified test results, as required by all specification sections.
 - "As-Built" print set.
 - Photocopy of Printout from Alarm Systems listing device addresses and custom labels.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION - (NOT USED)

END OF SECTION 28 00 51

SECTION 28 07 21 - FIRE ALARM AND DETECTION SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Contractor shall furnish, install and place in operating condition a new analog addressable electrically-operated, supervised, automated fire alarm system with voice signaling as described herein and as shown on the contract drawings.

1.03 STANDARDS AND CODES

- A. The system furnished under this specification shall comply with the applicable provisions of the following standards and codes:
 - 1. NFPA 70, National Electrical Code (Article 760)
 - 2. NFPA 101, Life Safety Code
 - 3. NFPA 72, National Fire Alarm Code
 - 4. State Codes
 - 5. Local Codes and Ordinances
 - 6. System shall be UL listed
 - 7. System shall be FM approved
- B. Protection systems supplier must provide proof of compliance with UL 864 to ensure levels of reliability and quality consistent with life safety signaling systems.

1.04 QUALIFICATIONS

- A. Fire alarm equipment shall be as manufactured and serviced by one of the following:
 - 1. Simplex Equipment as serviced and distributed by the direct factory Tyco SimplexGrinnell branch located in West Chester Township, Ohio. Telephone: 513-342-9001.
- B. All fire alarm equipment to be furnished shall be the standard product of a single manufacturer, unless specifically noted otherwise, and shall display the manufacturer's name on each component.
- C. System wiring shown on plans is based on Simplex equipment. It is the Electrical Contractor's responsibility to verify that the wiring shown on the drawings is adequate for the system to be furnished. All additional equipment and wiring that may be required should be included in the Contractor's bid.

1.05 SERVICES

- A. The equipment manufacturer shall have a local branch office staffed with trained, full-time employees who are capable of performing testing, inspection, repair and maintenance services for the life of the fire alarm system.

1.06 WARRANTY

- A. All components, parts and assemblies supplied by the manufacturer shall be guaranteed against defects in material and workmanship for a period of 12 months. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully staffed branch office located within a reasonable distance from the job site.

1.07 SUBMITTALS

- A. Prior to installation of any equipment or raceways, submit shop drawings to Engineer for approval. Submittals shall include:
 - 1. Equipment specification sheets.

2. Wiring diagrams with required color coding noted.
 3. Floor plans with wiring, addresses and symbol schedule.
 4. Riser Diagrams.
 5. Battery calculations (per NFPA 72) and a listing of spare capacity on each power supply in the system under normal and alarm conditions.
 6. Complete description of system operation.
 7. Listing of all materials furnished with the system.
 8. Elevation showing devices/locations of equipment to be installed in the VCC.
- B. The custom label requirements shall be provided by the Owner. The system supplier shall provide the Owner with one set of approved shop drawings with address labels and a print out (on 8-1/2" x 11" sheets) with corresponding addresses and blank column for custom labels to be filled in by Owner.
- C. AutoCAD floor plans are available to Vendors and Contractors to assist in generation of shop drawings. A nominal fee will be charged to prepare the plans for processing and email delivery of files. Refer to Division 1 Specifications for additional information.
- D. Fire alarm equipment supplier shall submit approved shop drawings to Building Department for plan review and permitting.

1.08 SYSTEM PROGRAMMING AND DOCUMENTATION

- A. The Equipment Supplier shall be responsible for the initial programming required to make the system perform as outlined under System Operation of this Specification.
- B. Custom label messages for the individual devices shall be defined at a later date (by the Owner) and shall be programmed by the Supplier (Supplier shall review all program labels with Owner prior to programming). The Owner reserves the right to request minor changes in the operation without incurring additional expense.
- C. Complete documentation of the system programming shall be furnished to the Owner prior to final acceptance.
- D. The Supplier shall furnish an Owner's Manual in electronic PDF format and including the following information:
1. Cut sheets and part numbers for all new initiating and indicating field devices, panel circuit boards, batteries, relays and various other components of the system.
 2. Instructions for the operation, preventative maintenance, trouble-shooting, and repair procedures for the various components of the system.
 3. A print out indicating all new device types, addresses, and custom label.
 4. As built drawings with device addresses and signal circuits.

1.09 SYSTEM OVERVIEW

- A. A Fire Alarm Control Panel/Voice Command Center (VCC) shall be installed in the first floor Fire Command Center and shall interface with a lobby annunciator panel and transponder cabinets on floors 4, 7, 10, and 13.
- B. Signaling devices shall be addressable audio/visual type with synchronized flash and wired such that the audio signal may be silenced and the visual indicator shall remain flashing until the system is reset.
1. Audio speakers shall be programmed to digitally announce floor in alarm.
- C. Door release circuits for egress doors shall be individually controlled from the VCC.
- D. System shall be interfaced with:
1. Elevators

2. Generators
 3. Stair pressurization fans
 4. Waterflow/tamper switches
 5. Fire/smoke dampers
- E. System shall have a digital dialer to call Owner's central station.

1.10 SYSTEM OPERATION

- A. The following outlines the system response to an incoming alarm or trouble condition:
1. When a manual pull station, heat detector, or smoke detector in **non-tenant** common spaces is activated:
 - a. Audible and visual indicating devices shall operate and digitally announce the preprogrammed message on the floor where the alarm occurs as well as the floor above and below the alarm, including tenant suites.
 - b. The fire alarm control panel and annunciator shall display the alarm condition and emit an audible tone.
 - c. The control panel shall alert the Owner's central station.
 - d. A hard copy printout on the remote printer shall be generated.
 2. When a smoke detector located in a **tenant** space is activated:
 - a. A 520 Hz audio signal and voice message shall sound via speaker within the living area and bedroom of the suite in alarm. Other building occupants will not be notified.
 - 1). In ADA suites, the visual notification appliances in the living area, bedroom, and bathroom shall also be activated.
 - b. The fire alarm control panel and annunciator panel shall display a trouble condition and emit an audible tone.
 - c. A hard copy printout on the remote printer shall be generated.
 3. When a duct smoke detector is operated:
 - a. The fire alarm control panel and annunciator shall display a supervisory condition and emit an audible tone.
 - b. The control panel shall alert the Owner's central station.
 - c. A hard copy printout on the remote printer shall be generated.
 - d. The detector shall close its associated damper, and
 - e. The detector shall shut down its associated AHU or fan servicing the monitored duct. All duct smoke detectors shall be programmed for alarm verification operation. Upon detector sensing an alarm condition, the device shall delay the initiation of the alarm for 60 seconds. After 60 seconds the detector shall verify that the alarm condition exists and if it does immediately initiate an alarm.
 - f. Duct smoke detectors integral relay shall be used for damper control and an addressable control module shall be used for AHU shutdown.
 4. When a tamper switch is operated:
 - a. The fire alarm control panel and annunciator shall display the trouble condition and emit an audible tone.
 - b. A hard copy printout on the remote printer shall be generated.

5. Individual panel, communication loop, or wiring failure:
 - a. The fire alarm control panel shall display the trouble condition.
 - b. If the wiring failure is on a communications loop, all field panels shall continue to monitor and control initiating loops and door controls within that individual panel.
 - c. If the wiring failure is on an individual monitor loop, the system will continue to operate with only the affected loop out of service.
- B. An alarm may be acknowledged at the fire alarm control panel or annunciator.
- C. When the system is operating on battery power, a trouble condition shall be generated after power outage exceeds 15 seconds. When AC power is restored, the system shall revert to the 120 VAC, 60 Hz supply without any manual restart procedures.

1.11 INTERFACING WITH OTHER EQUIPMENT

- A. Flow switches and tamper switches shall be furnished and set by the Mechanical (Division 15) Contractor. All devices are furnished with dry contacts for interconnection to the fire alarm system. The Electrical Contractor shall install all interconnection wiring between these devices and general fire alarm system via individual addressable modules (IAM's). (IAM's shall be furnished and installed by the Electrical Contractor).
- B. Electrical Contractor shall furnish and install duct detectors as indicated on the drawings. The exact location of the detectors shall be as directed by the Mechanical Contractor who shall make provisions in duct work for proper installation of detector housing. Fire/Smoke dampers shall operate on 120 volt. Dampers shall be furnished and installed by Mechanical Contractor and wired by Electrical Contractor.
- C. Stairwell pressurization fans shall be activated by a pull station, duct detector, heat detector or common space smoke detector in alarm or manually from the VCC. The VCC shall have H-O-A selector switches for separate control of the pressurization fans and have status LED's to indicate condition. The fan VFD's shall be provided with an output to "proof" the running condition. A smoke detector at the top of the stairwell shall override an "on" command from the VCC and shutdown the associated fan when in alarm to prevent the shaft from being filled with smoke laden air.
- D. Elevator Interface
 1. Three control modules shall be provided for elevator capture and notification. Two of the control modules shall be utilized for the primary and secondary elevator capture routine. The third control module shall be used to notify occupant in the elevator cabs (via the elevator controllers) that an initiating device in the machine room.
- E. Generator System Annunciation
 1. The fire alarm system shall monitor the generator system for a "Running" and "Trouble" condition.

PART 2 EQUIPMENT

2.01 FIRE ALARM CONTROL PANEL (FACP)/VOICE COMMAND CENTER (VCC)

- A. The fire alarm control panel shall be an analog addressable type, with LCD display, capable of communication with up to 2000 analog/addressable field devices via a twisted pair of wires. Approved equipment:
1. Simplex #4100ES (3-bay enclosure)
- B. The control panel shall minimally contain the following:
1. Dual paging amplifiers with 100% redundancy. Amplifiers shall be sized for 25% expansion capacity (minimum) on system.
 2. Network board
 3. Device communications boards.
 4. Digital messaging unit.
 5. Auto dialer (DACT) to alert central station of an alarm or trouble condition.
 6. Audio Signal Circuits. (6 minimum).
 7. Synchronized Visual Signal Circuits. (3 minimum).
 8. Relay boards.
 9. Additional cards/hardware as required to meet the signal and control circuit.
- C. NAC circuits shall be independently supervised and contain independently fused 24 VDC indicating circuits. The panel shall include support for synchronized device operation.
- D. All signal and device circuits shall be provided with isolation modules to prevent failure of 1 circuit affecting panel operating.
- E. The control panel shall receive 120 VAC power via a dedicated circuit breaker as noted on the plans. The incoming power to the system shall be supervised so that any power failure shall be audibly and visually indicated at the control panel. A "power on" LED shall be displayed continuously while AC power is present.
- F. The control panel shall be provided with sufficient battery capacity to operate the entire system upon loss of normal supervisory mode for a period of twenty-four (24) hours with five (5) minutes of alarm indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 70% capacity in 12 hours.
- G. The control panel shall have a dedicated system trouble LED and a dedicated trouble acknowledge switch.
- H. The control panel and auxiliary equipment shall be housed in an approximate 56"H x 24"W x 8-3/8"D surface wall mounted cabinet (Simplex 3 bay enclosure).
- I. Digital Messages
1. Provide 20 pre-programmed digital messages. Exact wording of messages shall be reviewed and approved by Owner. Messages shall be provided for the following:
 - a. Fire Alarm indicating floor in alarm (14 messages, 1st – 13th floor, penthouse)
 - b. Local alarm indicating smoke detected in apartment suite
 - c. General Alarm
 - d. Fire Drill
 - e. Tornado Warning

- J. The VCC shall include a paging microphone, control switches/LED's and status indicator lights as outlined below. (All switches and indicator lights shall have typed labels.)
1. Paging zone selector switches/indicator lights
 - a. First floor
 - b. Second floor
 - c. Third floor
 - d. Fourth floor
 - e. Fifth floor
 - f. Sixth floor
 - g. Seventh floor
 - h. Eighth floor
 - i. Ninth floor
 - j. Tenth floor
 - k. Eleventh floor
 - l. Twelfth floor
 - m. Thirteenth floor
 - n. Elevator machine room (roof)
 - o. Elevator lobbies
 - p. North stairwell
 - q. South stairwell
 2. Paging selector switches/indicator lights (4 total)
 - a. All talk
 - b. All Evac
 - c. Selective Evac
 - d. Local speakers
- K. The VCC shall contain H-O-A switches/indicator lights to control the following:
1. Stair Pressurization Fans (2 total)
 2. Elevator hoistway fan
- L. The VCC shall contain indicator lights for the following:
1. Generator status
 - a. Running
 - b. Summary alarm (Trouble condition)
 2. North and south stair pressurization status
 - a. Running
 3. Elevator hoistway fan
 - a. Running
- M. Panel shall have provisions for the addition of switches and indicator lights in the future.

2.02 TRANSPONDER CABINET

- A. Transponder cabinets shall include 24 VDC power supply, dual paging amplifiers with 100% redundancy and sized for 25% minimum expansion capacity, addressable device card, network card, 6 audio circuits and 3 synchronized visual NAC circuits. All circuits shall be provided with isolation modules to prevent failure of one circuit affecting panel operation. The control panel shall be provided with sufficient battery capacity to operate the entire system upon loss of normal supervisory mode for a period of twenty-four (24) hours with five (5) minutes of alarm indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 70% capacity in 12 hours.
1. Simplex #4100ES MINIPLEX transponder (3-bay enclosure)

2.03 VISUAL SIGNAL POWER SUPPLY PANELS

- A. Signal Power Supplies shall provide additional 24 VDC power for visual signaling devices. Panels shall communicate on the addressable data circuit and contain four synchronized general alarm circuits rated at 2 amps each. Each circuit shall be provided with a trouble LED. Panels shall include an 8 amp power supply with 12.7 Ah batteries and associated charger. Equipment shall be housed in a surface mounting cabinet 13-1/2"H x 16-1/2"W x 4-3/16"D. Simplex #4009 ID Net Series. Provide Wheelock #SM sync modules for NAC circuits. (Modules shall be housed in the signal panel or associated terminal cabinet).
1. Simplex #4009 ID Net.

2.04 TERMINAL CABINETS

- A. Terminal cabinets shall consist of a 26"W x 24"H x 4"D surface mounted cabinets with lockable hinged door, terminal strips with I.D. labels for field wiring and red finish.
1. Space Age Electronics #TCXA64.

2.05 FIELD DEVICES

- A. Annunciators shall contain 80-character LCD display (for custom message display), audible horn, keylock, and pushbuttons for signal silence, alarm acknowledge, and (4) auxiliary controls.
1. Simplex #4603-9101 (Flush mounted).
- B. Ceiling mounted smoke detectors shall have an analog addressable base with LED and photoelectric head.
1. Simplex #4098 series.
- C. Addressable manual pull stations shall be red, single action type with red semi-flush trim ring. Where pull stations are to be surface mounted, provide a red Wiremold two-gang (2-3/4" deep max.) box with red surface trim ring.
1. Simplex #4099 series.
- D. Heat detectors shall be programmable combination rate-of-rise and fixed temperature type (select to operate at 135°F).
1. Simplex #4098 series.

- E. Combination audio/visual devices shall consist of multi-tap speaker (1/4, 1/2, 1, 2W), 24VDC multi-candela, synchronized, Xenon, strobe and red finish.
 - 1. Simplex #4906 series (addressable notification appliances).
- F. Visual only devices shall be 24VDC multi-candela, synchronized, semi-flush mounted type with red finish and xenon strobes.
 - 1. Simplex #4906 series (addressable notification appliances).
- G. Addressable control modules shall contain two form C contacts, rated at 2 amperes, 120V.
 - 1. Simplex #4090-9002.
- H. Addressable monitor modules shall be individual type with integral end of line resistor.
 - 1. Simplex #4090-9001.
- I. Duct smoke detector assembly shall be an analog addressable type with photoelectric head, sampling tubes and 120V dual form C relay (0.5A at 120V) and remote alarm indicator station.
 - 1. Simplex #4098 series.
- J. Remote key reset/test station for each duct detector shall have an LED (to illuminate when duct detector is in alarm) and key switch (for testing the alarm circuitry). Key reset/test station shall be suitable for flush or surface mounting in 1-gang box.
 - 1. Simplex #2098-9806.

PART 3 EXECUTION

3.01 WIRING

- A. The Contractor shall furnish and install in accordance with manufacturer's shop drawings all wiring, conduit, and outlet boxes for the erection of a complete system as described herein and as shown on the Engineer's drawings (Engineer's drawings are for bidding purposes only and to indicate intent). All wiring shall be in conduit and of the same approved type as used for electric light and power wiring, and shall be those specified by the manufacturer. Color code shall be used and all wires shall be tagged at all junction points and shall test free from ground or crosses between conductors.
- B. All Fire Alarm devices shall be identified with its specific address using self laminating labels. Self-laminating labels shall be Brothers P-Touch type utilizing industrial grade tape, without exception.
- C. The underside of lay-in ceiling inverted tees shall be labeled in a durable fashion to indicate locations of concealed duct detectors, flow switches, tamper switches, etc.
- D. Junction boxes located above lay-in ceilings shall be painted red or identified with colored stick-on labels.
- E. Wiring shall be color-coded throughout and test free and clear of opens, grounds and crosses between conductors.
- F. All new initiating and indicating wiring shall be continuous between devices. Splicing shall be kept to a minimum.
- G. Temporary protection, agreed to by the Owner, shall be provided by the Electrical Contractor in existing areas where the fire alarm system is to be disconnected for an extended period of time.

3.02 TESTING

- A. Upon completion, the Contractor shall conduct a total system test for the Owner. At minimum, this test shall include:
 - 1. Operating all initiating devices.
 - 2. Verify line supervision of each initiating circuit and indicating circuit.

3. Verifying the Class B, four-wire operation of each initiating circuit (where applicable).
 4. Verifying complete system operation.
 5. Wiring shall be checked and tested by the Electrical Contractor in accordance with the instructions provided by the manufacturer to insure that the system is free of grounds, shorts, opens, and that the insulation resistance between current carrying conductors is 10 Megohms or greater.
- B. The Division 26 Contractor shall schedule all testing in advance with the Owner and the Fire Department. All testing will be witness by Owner and Fire Department personnel.

3.03 DOCUMENTATION

- A. The Contractor shall provide operation and maintenance manuals and As-Built drawings including plan layout, conduit runs, and wiring diagrams as finally installed as required by Section 260051.
- B. Upon completion of the installation, a factory-trained technician shall perform all necessary tests and adjustments and who shall then file a letter of certification with the Owner indicating that the system functions and conforms to prescribed standards.

END OF SECTION 28 07 21