



Division 17 Notice

For this project, selected MasterFormat 2004 specifications may be displayed in Division 17000.

Applicable Divisions are outlined in the Table of Contents

Division 17000-Other: May contain one or more of the following MasterFormat 2004 Divisions:

- Division 21 Fire Suppression
- Division 22 Plumbing
- Division 23 Heating, Ventilating, and Air Conditioning
- Division 25 Integrated Automation
- Division 26 Electrical
- Division 27 Communications
- Division 28 Electronic Safety and Security
- Division 31 Earthwork
- Division 32 Exterior Improvements
- Division 33 Utilities
- Division 34 Transportation
- Division 35 Waterway and Marine Construction
- Division 40 Process Integration
- Division 41 Material Processing and Handling Equipment
- Division 42 Process Heating, Cooling, and Drying Equipment
- Division 43 Process Gas & Liquid Handling, Purification, & Storage Equipment
- Division 44 Pollution Control Equipment
- Division 45 Industry-Specific Manufacturing Equipment
- Division 48 Electrical Power Generation

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**PROJECT
BID DOCUMENTS, CONTRACT REQUIREMENTS & GENERAL REQUIREMENTS**

for the construction of

**Ozarks Technical Community College Richwood Valley
Campus FEMA Shelter Infill**

**TO BE LOCATED AT
3369 W. Jackson St.
Nixa, Missouri 65714**

FOR:

**OZARKS TECHNICAL COMMUNITY COLLEGE
1001 EAST CHESTNUT EXPRESSWAY
SPRINGFIELD, MO 65802**

**OWNER'S REPRESENTATIVE:
Harlan Hill, College Architect
Phone: 417-447-4810
Fax: 417-447-4804**

Prepared by:

**Bates & Associates Architects
106 N 37th St. Suite C
Rogers, AR 72756
(479) 633-8155
FAX: (417) 865-8317**

**Architect's Project Number
15088**

Date of Documents:

April 27, 2016

SPECIFICATION MANUAL

SECTION 00002 - PROJECT DIRECTORY

Owner: Ozarks Technical Community College
1001 East Chestnut Expressway
Springfield, Missouri 65802
(417) 447-4852
(573) 447-4823 Fax

Contact: Owner's Representative
Harlan Hill, College Architect
Ozarks Technical Community College
1001 E. Chestnut Expressway
Springfield, MO 65802
Phone: (417) 447 4810
Fax: (417) 447 4804
E-mail:
hillh@otc.edu

Architects: Bates & Associates Architects
106 N 37th St. Suite C
Rogers, AR 72756
Phone: (479) 633 8155
Fax: (417) 865 8313

Contact: Ryan Faust - Project Manager rf@batesarchitects.com
RG Foster – Construction Admin. rg@batesarchitects.com

MEP Engineer: Smith-Goth Engineers, Inc.
3855 S. Jefferson Ave.
Springfield, Mo 65807
Phone: (417) 882 2200
Fax: (417) 882 1188

Contact: Abby Thurman, P.E. athurman@smithgoth.com

REGISTRANTS

The personal seal of the registered Architect or Engineer shall be the legal equivalent of his signature whenever and wherever used, and the owner of the seal shall authenticate this sheet and the specification sections pertaining to this sheet. Responsibility shall be disclaimed for all other plans, specifications, estimates, reports or other documents or instruments relating to or intended to be used for any part or parts of this project.

Those sections each discipline is responsible for shall be as listed alongside seal of same.

ARCHITECT Sections:

All divisions of 5, 6, 7, 8, 9, 10, 11, as included herein.



Architects observation: Signatures within this Section attest that to the best of his ability, all Drawings, Specifications, and Calculations submitted by the Architect (And his consultants) to the Owner has been reviewed for accuracy, completeness, and coordinated within disciplines. However, nothing within this document suggests a Standard of Care greater than that required by other professional practitioners providing services in Missouri.

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4/27/16

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I HEREBY DISCLAIM ANY RESPONSIBILITY FOR PLANS, SPECIFICATIONS OR OTHER DOCUMENTS TO BE USED ON THIS PROJECT NOT PREPARED BY ME.

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SECTION 00090 – INVITATION TO BID

GENERAL: To be considered, Bids must be made in accordance with these **Instructions to Bidders**.

SEALED PROPOSALS:

For the construction of

**OZARKS TECHNICAL COMMUNITY COLLEGE RICHWOOD VALLEY CAMPUS FEMA SHELTER INFILL
TO BE LOCATED AT
3369 W. JACKSON ST.
NIXA, MISSOURI 65714**

Architect's Project Number **15088**

Date of Documents:

April 27, 2016

THE PROJECT:

The site is located at 3369 w. Jackson St. Nixa, MO directly east of the existing OTC Richwood Valley Campus main building. The proposed infill includes multiple classrooms and office/lobby area with restrooms and IT support spaces in the FEMA building and a lobby remodel to the main campus building including work in the boiler room for the additional load provided by the FEMA building. The scope of work shall include all finishes, MEP, and owner provided coordination items as shown in the documents for the applicable spaces.

BID PERIOD:

Wednesday, April 27, 2016 through Wednesday, May 25, 2016 at 2:00 p.m.

PRE-BID CONFERENCE (Mandatory) :

A pre-bid conference is scheduled for Tuesday, May 10, 2016 at 2:00 p.m. at the OTC Richwood Valley Campus FEMA Building at 3369 W. Jackson St. Nixa, MO 65714. The Owner, College Architect, and Bates & Associates will make a presentation and take questions. All General Bidders, and major subcontractors are urged to attend.

Questions during the bidding process shall be submitted in writing to Bates & Associates, Inc., 106 N 37th St. Suite C, Rogers, Arkansas 72756, Phone: 479-633-8155, Fax: 417-865-8313, E-mail: rf@batesarchitects.com.

BIDDING:

Sealed bids for the Ozarks Technical Community College Table Rock Expansion shall be received at the Location of the Owner:

Harlan Hill, College Architect
Ozarks Technical Community College
Operations Center Building
933 E. Central Street
Springfield, MO 65802

Bids shall be submitted no later than 2:00 p.m. CDT, Wednesday, May 25, 2016. A Sub-Contractor listing shall be submitted with the bid.

The Bid Form, all bid submittal requirements, including but not limited to the Statement of Qualifications,

Bid Form, Bid Security, E-verify affidavit, and the Sub-Contractor listing must all be received to be considered a Complete Bid Proposal. Complete Bid Proposals will be opened and tabulated in a public bid opening at 2:05 p.m. May 25, 2015 at the office of the College Architect. Bids shall be submitted enclosed in a sealed envelope addressed and marked **OTC – RICHWOOD VALLEY CAMPUS FEMA SHELTER INFILL**. This envelope shall also bear the name of the bidder. A minimum of (1) one original sealed submittal of all requested forms is required at the time of Bid. Bids shall include all freight, overhead and profit, and any other miscellaneous charges relating to the work.

The bidder understands that the Owner (Ozarks Technical Community College acting in behalf of the Public Building Corporation) reserves the right to award the contract to the **lowest responsible bidder** and to reject any or all bids and / or to waive any technicalities or informalities in the bidding. No bids may be withdrawn for a period of sixty (60) days subsequent to the specified time for receipt of bids.

Bids shall be submitted with all appropriate blank spaces completed. Numbers shall be stated both in writing and in figures. In case of any discrepancy in the lump sum amount, the amount as expressed in written words shall govern. The signatures shall be without interlineation, alteration, or erasure, unless initialed by the Bidder. Bids shall not contain any recapitulation for the work to be done.

If the Bidder is a corporation, the Bid shall contain the legal name of the corporation and shall be signed by a duly authorized officer, and the corporate seal affixed; if a partnership, it shall be signed by one of the partners authorized to execute documents and shall give the names of and addresses of all partners.

Bidder shall be responsible for actual delivery of his Bid to the address indicated. It shall not be sufficient to show that the bid was mailed in time to be received before the scheduled closing time for receipt of bids.

Any bids received **after the time and date stated** shall be returned unopened.

BID SECURITY:

Each bid shall be accompanied with a bid security consisting of a bid bond, certified check, or cashier's check on a solvent bank in the amount of 5% of the base bid amount. Bid security shall be made payable without condition to the Owner.

Bid security will be retained by the Owner to whom an award is being considered until either (a) the contract has been executed and bonds have been furnished, (b) the specific time has elapsed so that Bids may be withdrawn, or (3) all Bids have been rejected.

BIDDERS STATEMENT OF QUALIFICATIONS:

A completed Statement of Qualifications form must be submitted to the Architect at the time of bidding and be a part of the Bid Submittal Package.

BID DOCUMENTS, DRAWINGS AND SPECIFICATIONS:

Bid Documents, Drawings and Specifications and other related contract information may be obtained after April 27, 2016 at the following location:

Drawings and Specifications and other related contract information may be obtained through the Architect's office by requesting digital access to the Architect's file management dashboard via email to rf@batesarchitects.com or by phone 479-633-8155. In addition, drawings can be accessed at Engineers Reprographics, 1600 E. Saint Louis St, Springfield, MO 65802-3130, 417-869-2222 www.erdigital.com/. Plans will also be available from Springfield Blueprint Co. online plan room, www.spfdblue.com. Documents shall be issued at cost of printing (non-refundable) for each set. Bid Documents.

PERFORMANCE BOND:

A Payment and Performance Bond is required of the successful Bidder in the amount of 100 percent of the contract.

TAX EXEMPT STATUS:

Bidders are hereby instructed to submit bids not including sales tax according to the provisions of Section 144.062 RSMo. The selected contractor will receive a Missouri Tax Exemption letter from the Owner to use in purchasing materials on a tax-free basis. It will be the responsibility of the contractor to provide the documentation to any subcontractor. This document will be used solely for purchase of materials being directly incorporated into or consumed in the construction of the work under this contract.

WAGE RATES:

The minimum prevailing wage rates as determined by Missouri Division of Labor Annual Wage Order No. 22 (Christian County) shall be paid. Contractor must pay employees wages and benefits equal to or greater than the established scale. Contractor may be required to submit certified payroll information, on a periodic basis, and a final payroll Affidavit form at close of this project.

MBE/WBE COMPLIANCE:

The Owner desires Minority Business Enterprise/Women Business Enterprise (MBE/WBE) participation in this Project. Every feasible effort shall be made to target the percentage of goods and services procured from certified MBE's and WBE's to 10% and 5% respectively.

E-VERIFY:

Bidder shall furnish an affidavit and documentation affirming their company is enrolled in and participates in E-Verify/Basic Pilot and an affidavit stating the business does not knowingly employ illegal aliens.

SCHEDULE:

Pre-Bid Meeting Date and Time: Tuesday, May 10, 2016 at 2:00 p.m.

Bid-Date and Time: Wednesday, May 25, 2016 at 2:00 p.m.

Intended Award Date: Tuesday, June 14, 2016

Expected Construction Start Date: Monday, June 20, 2016

Substantial Completion Date: Wednesday, November 16, 2016

Final Completion: Friday, December 2, 2016

LIQUIDATED DAMAGES

Work for this project shall be substantially completed by the date and time specified by the Owner or as proposed by the successful Bidder on the Bid Form, whichever is the shorter time frame. Liquidated damages of \$1,000.00 per calendar day will apply after this time and date.

Final Completion is that time the Architect certifies the Final Application for Payment.

END OF SECTION 00090

SECTION 00120 - BIDDER'S STATEMENT OF QUALIFICATIONS

- A. All bidders shall submit a Bidders Statement of Qualifications form. Qualification statements must be submitted to the Owner as a part of the Bid. This document is included at the end of this section.
- B. Financial Statements are not required except upon specific request of the Owner through the Architect on behalf of the Owner. The Financial Statement therefore will not become a matter of public record, and will be reviewed in strictest confidence.
- C. Acceptance: Receipt of the Qualification Statement shall in no way constitute acceptance or approval, or acknowledgment that a Contractor is qualified. However, the Architect, acting on behalf of the owner, may make more in depth inquiry on issues of concern created by information gathered, and will report that outcome to the owner for action regarding owner evaluation. Decisions regarding acceptability are ultimately the Owner's sole responsibility.
- D. Denial of a Bid, or determination by the owner of a bidder not approved, based on qualification, will be determined by the Owner, on advice of counsel.

END OF SECTION

BIDDER QUALIFICATION FORM

(Firm must prepare this statement in the form shown)

The undersigned bidder certifies that the information herein is true, correct, complete and accurate. (Elaboration on the following information or additional information deemed to be useful for evaluation of bidder's capabilities or to prevent misleading representations may be attached to this form.)

Date: _____

Bidder: _____
(Legal Name of Firm)

State of Missouri current registration or license number: _____

Federal ID No. _____

Address: _____

Phone Number: _____ /FAX Number _____

E-Mail Address _____

President: _____ (or Managing Partner, etc.)

Dun and Bradstreet No.(if any) _____

Years in business under present name: _____

List all other names under which your business has operated in last 10 years:

Insurance Company:

Insurance Agent: _____ Phone:

Total staff employed by firm: _____ (Break down by Managers and Trades.)

Contracting Specialty (indicate trades in which bidder performs.)

Union affiliations: Local _____ National _____

Years performing work specialty:

% work performed by Firm's own forces:

Is Bidder in compliance with all applicable EEO requirements?

Yes ___ No ___ (If the answer is no, please attach summary of details on a separate sheet.)

Bank references:

Address:

Contact name:

Contact phone #:

Has firm or predecessor firm been involved in a bankruptcy or reorganization?

Yes____ No____ (If the answer is yes, please attach summary of details on a separate sheet.)

List on a sheet attached hereto all judgments, claims, arbitration proceedings, or suits pending or outstanding against bidder over the last five (5) years with amount of claim and brief description.

List on a sheet attached hereto all lawsuits or requested arbitration with regard to construction contracts which bidder has initiated within the last five (5) years and brief explanation of claim and outcome.

* PLEASE INCLUDE THREE (3) REFERENCES WHEN YOUR BID IS SUBMITTED

(This completed form (with all attachments) and statement must be certified true and correct by affidavit sworn before a Notary Public in form as follows.)

Company Officer

Notary Public

SECTION 00400 - SUBCONTRACTOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

PART 2 - SUBCONTRACTS

- A. General Contractor and all subcontractors shall use the AIA Family of Documents unless approved otherwise by the owner. The use of any other format of subcontract shall not relieve the Contractor and Subcontracts of compliance with all requirements of the Contract with the Owner.
- B. Subcontracts shall comply with Section 00700 the General Conditions and Agreement.

END OF SECTION 00400

SECTION 00410 – BID FORM

BID FOR LUMP SUM CONTRACT

Date: _____

Proposal of _____ (herein called "Bidder")

*a corporation organized and existing under the laws of the State

of _____, *a partnership consisting

of _____, or *an individual trading

as _____.

*(*insert name of corporation, partnership, or individual as applicable.)*

To: Ozarks Technical Community College
1001 E. Chestnut Expressway
Springfield Missouri, 65802
Phone 417-447-4806
Fax 417-447-4804

- 1. The Bidder, in compliance with the Instructions to Bidders for the **Ozarks Technical Community College Richwood Valley Campus FEMA Shelter Infill**, in accordance with the Drawings and Specifications prepared by Bates & Associates and Consultants for the project entitled:

**Ozarks Technical Community College Richwood Valley Campus FEMA Shelter Infill
For
Ozarks Technical Community College**

Architect's Project Number **15088**

Date of Documents:

April 27, 2016

having examined the Drawings and Specifications with related documents and the site of the proposed work, and being familiar with all the conditions pertaining to the construction of the Storm Shelter and related work, including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies to construct the project in accordance with the Contract Documents, within the time set forth herein at the prices stated below. These prices are to cover all expenses, including taxes and fees required by local ordinances, which are incurred in performing the work required under the Contract Documents, of which this Bid is a part.

The Bidder acknowledges that Addenda Nos. _____ have been received and considered in the preparation of this proposal.

The Bidder proposes to complete bid items awarded in _____ calendar days from Notice to Proceed.

In the following Bid the amount shall be shown in both words and figures. In case of discrepancy between the words and the figures, the words shall govern. It is understood that the bid evaluation for award of contract is based on the Base Bid plus accepted alternates.

3. BID PRICING:

A. BASE BID:

The Bidder agrees to furnish all labor, materials, tools, and equipment required to complete the construction work shown on the Drawings and called for in the Specifications for the sum of:

_____ Dollars \$(_____)

B. ALTERNATE BIDS:

The above Base Bid may be changed in accordance with the following Alternate Bids as the Owner may elect. These Alternates are as described in Section 01230 Alternates of the Project Manual and/or shown on the Drawings. This is a one contract project; therefore, the Alternates are to be studied by each Bidder to determine their effect on the bids of the General Contractor and each subcontractor and/or material supplier.

1. BID ALTERNATE #1:

The Bidder agrees to furnish all labor, materials, tools, and equipment required to complete the construction work shown on the Drawings and called for in the Specifications for the sum of:

_____ Dollars \$(_____)

4. CHANGES IN THE WORK

Changes in the Work shall be as established in the Contract Documents. The following fees shall be used for lump sum pricing and actual cost pricing of additions and deletions to that Work not otherwise included in the Bid, namely:

	<u>Profit & Overhead</u>	<u>Not to Exceed</u>
A. To Contractor for work performed by his own forces	_____ %	10%
B. To Contractor for work performed by other than his own forces	_____ %	5%
C. To Subcontractor for work performed by his own forces	_____ %	10%
D. To Subcontractor for work performed by other than his own forces	_____ %	5%

6. PROJECT COMPLETION:

Contract Period: The Contract period begins on the day the Contractor receives the Notice to Proceed.

The bidder agrees to complete the project on or before the following dates:

Substantial Completion: November 16, 2016

Final Completion: December 2, 2016

Completion dates are established to permit Owner to occupy the facility and set up for classes. By submitting the bid the bidder represents that adequate allowance has been provided to accommodate bad weather, organized labor issues coordination, and other conditions normally attributed to justifiable claim for additional time. No claim will be made for additional time except as described in the Instruction to Bidders.

Commencement: Contractor agrees to commence work on this project after the Notice to Proceed is issued by the Owner.

Liquidated Damages: The Contractor agrees to pay to, or allow, the Owner as Liquidated Damages the following amounts: Failure to achieve Substantial Completion by November 16, 2016, \$1,000.00 per calendar day continuing daily until Architect issues a Certification for Substantial Completion.

Lowest and Best Bid: The Contractor acknowledges time is of the essence for this project. The Contractor acknowledges and agrees that the Owner reserves the option of selecting the Contractor based on the **Lowest Responsible Bid**. The Bidder agrees to hold the Owner and Architect harmless and will make no claim against the Architect or Owner for awarding a Lowest Responsible Bid or disqualifying a bidder. Refer to Sect.00090 Instructions to Bidders, for clarification of issues the Owner may choose to consider in determining "lowest responsible bid".

Documents to Accompany Bids: The bidder shall be aware that the following fully executed documents are required in order for his or her bid to be considered.

1. Non-collusion Affidavit (Section 00480)
2. Bid Form (Section 00410)
3. Bid Security (detailed in Section 00090)
4. Statement of Qualifications (Section 00120)
5. E-Verify Affidavit (Section 00440)

7. SUBCONTRACTOR LIST:

A list of subcontractors shall be submitted to the Owner at the time of the bid opening.

8. BIDDER'S ACKNOWLEDGMENTS:

The Bidder declares that he or she has had an opportunity to examine the site of the work and he or she has examined the Contract Documents therefore; that he or she has carefully prepared his or her Bid upon the basis thereof, that he or she has carefully examined and checked this Bid and the materials, equipment, and labor required thereunder, the cost thereof, and his or her figures therefor, and hereby states that the amount, or amounts, set forth in this Bid is, or are, correct and that no mistake or error has occurred in this Bid or in the Bidder's computations upon which this Bid is based, and the Bidder agrees that he or she will make no claim for reformation, modifications, revisions, or correction of this Bid after the scheduled closing time for the receipt of Bids.

In submitting this Bid, it is agreed that it may not be withdrawn for a period of sixty (60) days

after the scheduled closing time for receipt of Bids.

The Bidder understands that the Ozarks Technical Community College reserves the right to award the contract to the lowest responsible bidder and to reject any or all bids and / or to waive any technicalities or informalities in the bidding.

Accompanying the Bid is a Bid Bond payable without condition to Ozarks Technical Community College, which is an amount at least equal to five percent (5%) of the amount of the largest possible total Bid herein submitted.

Accompanying the Bid is the Bidder's Statement of Qualifications, List of Sub-contractors, and Bid Bond.

It is understood and agreed that if this Bid shall be accepted and the undersigned shall fail to execute the Contract and furnish acceptable bond as provided by the Contract Documents, the accompanying Bid Security will be realized upon or retained by the Owner. Otherwise, the Bid Bond shall be returned to the undersigned. It is understood that the Bid Security of the three (3) lowest and best Bidders will be retained until the Contract has been executed and an acceptable bond has been furnished, when Bid Security will be returned. Once the Contract has been awarded, the Security Bid Bonds will be destroyed and other alternate forms of Bid Securities returned.

9. BIDDER'S CERTIFICATE:

The Bidder hereby certifies:

- a) That his or her bid is genuine and is not made in the interest of or on behalf of any undisclosed person, firm or corporation, and is not submitted in conformity with any agreement or rules of any group, association or corporation.
- b) That he or she has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid.
- c) That he or she has not solicited or induced any person, firm or corporation to refrain from bidding; and
- d) That he or she has not sought by collusion or otherwise to obtain for himself or herself any advantage over any other Bidder or over the Owner.
- e) That he or she will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with the performance of the work.
- f) That this is a Prevailing Wage Project and the Bidder will comply with statutes and requirements of the Documents.
- g) That this is a Tax Exempt Status project and the Bidder will work to assist the Owner in participating in the benefits of the provision and comply with requirements of the Exempt Status option.
- h) That he or she is familiar with the requirements for primary responsibility to coordinate tie-in work to the adjacent building and will comply with the conditions of the contract and cooperate with the Architect in fulfilling his administration responsibilities to the contract.

- i) That he or she will comply with requirements for the Project Schedule and that schedule will become one of the communication devices for communicating project progress to the Architect and Owner.
- j) That liquidated damages will be assessed after the Construction Period has expired.
- k) That Lowest Responsible Bid will prevail over Lowest Base Bid.

10. BIDDER'S SIGNATURE:

Note: All signatures must be original, not copies, Xeroxed, stamped, etc.

IF A CORPORATION:

Name of Corporation

1. Incorporated under the laws
of the State of _____.

Name and Title of Officer

2. Licensed to do business in
Missouri:
Yes: _____ No: _____
(Check One)

Signature of Officer

Address for Communications

Telephone Number

IF A PARTNERSHIP:

Name of Partnership

Name and residence addresses of
all partners:

Signature of Partner

Address for Communications

Telephone Number

IF AN INDIVIDUAL:

Residence Address:

Signature of Individual

Address for Communications

Telephone Number

IF A JOINT VENTURE:

Name of Corporation

1. Incorporated under the laws
of the State of _____.

Name and Title of Officer

2. Licensed to do business in Missouri:
Yes: _____ No: _____
(Check One)

Signature of Officer

Address for Communications

Telephone Number

Name of Corporation

1. Incorporated under the laws
of the State of _____.

Name and Title of Officer

2. Licensed to do business in Missouri:
Yes: _____ No: _____
(Check One)

Signature of Officer

Address for Communications

Telephone Number

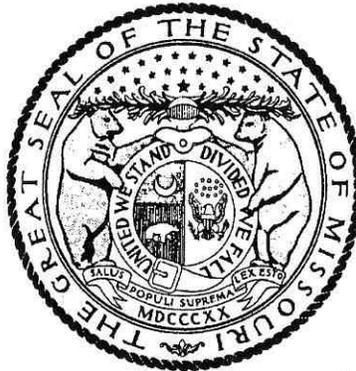
(Each Bidder must complete the bid form by manually signing on the proper signature line above and supplying the required information called for in connection with the signature. The information called for is necessary in the proper preparation of the contract and performance bond. Each Bidder must supply the data called for "Statement of Bidder's Qualifications.")

END OF SECTION 00410

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



JEREMIAH W. (JAY) NIXON, Governor

Annual Wage Order No. 22

Section 022

CHRISTIAN COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by _____

John E. Lindsey, Director
Division of Labor Standards

This Is A True And Accurate Copy Which Was Filed With The Secretary of State: **March 10, 2015**

Last Date Objections May Be Filed: **April 9, 2015**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	** Date of Increase	*	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits
Asbestos Worker (H & F) Insulator			\$20.50	FED		\$3.45
Boilermaker	8/15		\$34.76	57	7	\$28.00
Bricklayer and Stone Mason	6/15		\$27.52	24	74	\$15.78
Carpenter	6/15		\$24.34	61	4	\$15.10
Cement Mason	6/15		\$22.96	64	4	\$10.10
Communication Technician			\$14.20	FED		\$5.07
Electrician (Inside Wireman)	11/15		\$25.15	21	48	\$11.85 + 10%
Electrician (Outside-Line Construction\Lineman)	10/15		\$41.52	125	65	\$5.00 + 34.5%
Lineman Operator	10/15		\$38.37	125	65	\$5.00 + 34.5%
Groundman	10/15		\$26.76	125	65	\$5.00 + 34.5%
Elevator Constructor	6/15	a	\$43.620	26	54	\$29.956
Glazier	10/15		\$23.35	36	52	\$6.21
Ironworker	6/15		\$31.25	50	4	\$27.90
Laborer (Building):						
General	6/15		\$20.90	112	4	\$11.37
First Semi-Skilled	6/15		\$22.78	112	4	\$11.37
Second Semi-Skilled	6/15		\$21.58	112	4	\$11.37
Lather			USE CARPENTER RATE			
Linoleum Layer and Cutter	6/15		\$24.24	123	78	\$15.10
Marble Mason	10/15		\$21.66	124	74	\$12.68
Marble Finisher	10/15		\$14.14	124	74	\$9.08
Millwright	6/15		\$24.34	61	4	\$15.10
Operating Engineer						
Group I	6/15		\$26.00	84	4	\$12.23
Group II	6/15		\$24.31	84	4	\$12.23
Group III	6/15		\$23.60	84	4	\$12.23
Group III-A	6/15		\$24.31	84	4	\$12.23
Group IV						
Group V	6/15		\$15.60	84	4	\$12.23
Painter	6/15		\$21.88	7	14	\$11.98
Pile Driver	6/15		\$24.34	61	4	\$15.10
Pipe Fitter	11/15		\$28.95	19	1	\$14.67
Plasterer	6/15		\$22.95	64	4	\$10.30
Plumber	11/15		\$28.95	19	1	\$14.67
Roofer \ Waterproofer	6/15		\$22.50	10	2	\$10.38
Sheet Metal Worker			\$28.87	4	24	\$13.15
Sprinkler Fitter - Fire Protection	6/15		\$32.39	33	19	\$19.05
Terrazzo Worker			\$28.73	124	74	\$14.38
Terrazzo Finisher			\$18.68	124	74	\$14.38
Tile Setter	10/15		\$21.66	124	74	\$12.68
Tile Finisher	10/15		\$14.14	124	74	\$9.08
Traffic Control Service Driver			\$16.35	48	49	\$2.75
Truck Driver-Teamster						
Group I			\$19.45	98	4	\$4.72
Group II						
Group III			\$19.45	98	4	\$4.72
Group IV			\$19.45	98	4	\$4.72

Fringe Benefit Percentage is of the Basic Hourly Rate

**Annual Incremental Increase

**REPLACEMENT PAGE
CHRISTIAN COUNTY
BUILDING CONSTRUCTION OVERTIME SCHEDULE**

FED: Minimum requirement per Fair Labor Standards Act means time and one-half (1 ½) shall be paid for all work in excess of forty (40) hours per work week.

NO. 4: Means the regular working day shall consist of eight (8) hours labor on the job between six (6) a.m. and six-thirty (6:30) p.m. and the regular working week shall consist of five (5) consecutive eight (8) hour days beginning with Monday and ending with Friday of each week. All full time or part time labor performed during such hours shall be recognized as regular working hours and paid for at the regular hourly rate. All work performed outside the regular working hours and performed during the regular work week and Saturday work, shall be paid at one & one-half (1½) times the regular rate. All recognized holidays or days locally observed as such, and Sundays shall be paid at the double (2) time rate of pay. Also, there may be a 40-hour work week which would consist of ten (10) hours each day for Monday, Tuesday, Wednesday, Thursday or Friday.

NO. 7: Means work between the hours of 7:00 a.m. and 6:00 p.m. daily, Monday through Saturday, as assigned by the Employer shall be considered regular hours. Weekend work shall be paid at the rate of one and one-half (1 ½) times the regular rate of pay. Weekend begins 12:01a.m. Saturday. Overtime is time worked over forty (40) hours per pay period, and shall be paid at the rate of one and one-half (1½) times the regular rate of pay. Sunday and Holidays will be paid at the rate of two (2) times the regular rate of pay.

NO. 10: Means the regular working day shall be scheduled to consist of at least eight (8) hours but no more than ten (10) consecutive hours, exclusive of the lunch period, unless otherwise provided. Crews shall be scheduled to commence at any time between the hours of 5:00 a.m. and 10:00 a.m. or earlier if agreed on by the majority of any one crew. Except as specifically provided for Saturdays, Sundays and holidays, all work performed by Employees anywhere in excess of forty (40) hours in one (1) work week, or in excess of ten (10) hours in one work day shall be paid at the rate of one and one-half (1½) times the regular hourly wage scale. Any work performed on a Saturday shall be paid at the rate of one and one-half (1½) times the regular hourly wage scale unless such Saturday work falls under the category of Saturday make Up Day. When this Saturday Make Up Day does occur, the Employee may work on Saturday at straight time; provided, however, if during the period worked by said Employee on Saturday, the Employee's compensable time at the straight time rate exceeds forty (40) hours, all time worked in excess of the forty (40) hours will be paid at the rate of one and one-half (1½) time the regular hourly wage scale. The provision of this Saturday Make Up Day shall not apply to any weeks in which a designated holiday is recognized. Any work performed by Employees anywhere on Sunday or holidays shall be paid at the rate of double (2) time the regular wage scale.

NO. 19: On single shift operation, eight (8) hours of work, between 8:00 a.m. and 4:30 p.m., shall constitute a day's work. Forty (40) hours of work Monday through Friday shall constitute a workweek. The starting time may be changed to begin between the hours of six (6:00) and ten (10:00) a.m. The first two (2) hours performed in excess of an eight (8) hour workday Monday through Friday, and the first ten (10) hours on Saturday, shall be paid at time and one-half (1.5) the basic straight-time rate. All work performed on Sundays and holidays, and in excess of ten (10) hours a day shall be paid at double (2) the basic straight time rate of pay. When hours worked are outside of established work hours, the pay rate shall be one and one-half (1.5) times the regular rate of pay for the first ten (10) hours, and all hours in excess of ten (10) hours shall be at the double-time rate. Shift work of either one (1) eight hour night shift, or two (2) eight (8) hour night shifts on a job which will continue for at least one (1) week, all employees shall be paid eighteen and one-half percent (18.5%) over the straight-time hourly rate on the night shifts. All hours worked in excess of eight (8) in a shift shall be paid at the applicable overtime rate of pay. The normal workweek may be changed to four (4) ten (10) hour days or four (4) ten (10) hour nights, if on shift work, with the following provisions: Monday through Thursday would be the normal workweek with Friday being used as scheduled workday in case of a day being lost due to weather, all employees working night shift, on a job that will continue at least one (1) week, shall be paid thirty percent (30%) over the regular straight-time hourly rate of pay, and any hours worked before or after established starting and quitting times being paid at double (2) time hourly rates of pay.

**REPLACEMENT PAGE
CHRISTIAN COUNTY
BUILDING CONSTRUCTION OVERTIME SCHEDULE**

NO. 21: Means eight (8) hours of work between the hours of 8:00 a.m. and 4:30 p.m. shall constitute a work day. Forty (40) hours within five (5) days, Monday through Friday, shall constitute a work week. The regular starting time of a job may be moved not more than two (2) hours prior to 8:00 a.m. However, in no case shall more than eight (8) hours be worked per day without the applicable overtime rate being paid. When job conditions dictate, the Employer shall be allowed to establish a four (4) day, ten (10) hours per day work week. This work week is defined as Monday through Thursday or Tuesday through Friday. All hours worked in excess of ten (10) hours per day or forty (40) hours per week shall be paid at the applicable overtime rate. This language is not intended to change the normal five (5) day, eight (8) hour per day work week. All overtime work performed after the regularly scheduled working hours Monday through Friday and Saturday shall be paid for at time and one-half (1½) the regular straight time rate of pay. Sundays and recognized holidays shall be paid for at two (2) times the straight time rate of pay. Shift work performed between the hours of 4:30 p.m. and 1:00 a.m. (second shift) shall receive eight (8) hours pay at the regular hourly rate of pay plus 17.3% for all hours worked. Shift work performed between the hours of 12:30 a.m. and 9:00 a.m. (third shift) shall receive eight (8) hours pay at the regular hourly rate of pay plus 31.4% for all hours worked. An unpaid lunch period of thirty (30) minutes shall be allowed on each shift. All overtime work required before the established start time and after the completion of eight (8) hours of any shift shall be paid at one and one-half (1½) times the shift hourly rate.

NO. 24: Means eight (8) hours shall constitute a day's work on all classes of work between the hours of 6:00 a.m. and 5:30 p.m., Monday through Friday. The pay for time worked during these hours shall be at the regular wage rate. The regular workweek shall be Monday through Friday. A workweek of four (4), ten (10) hour days may be established on a per job basis. Saturday may be used for a make-up day, when working 5-8's, Friday when working 4-10's. All time worked before and after the established workday of eight (8) hours, Monday through Friday, and all time worked on Saturday shall be paid for at the rate of time and one-half (1½) except after eight (8) hours worked, then double (2) time will apply. All time worked on Sundays and the recognized holidays shall be paid at the rate of double (2) time.

NO. 26: Means that the regular working day shall consist of eight (8) hours worked between 6:00 a.m., and 5:00 p.m., five (5) days per week, Monday to Friday, inclusive. Hours of work at each jobsite shall be those established by the general contractor and worked by the majority of trades. (The above working hours may be changed by mutual agreement). Work performed on Construction Work on Saturdays, Sundays and before and after the regular working day on Monday to Friday, inclusive, shall be classified as overtime, and paid for at double (2) the rate of single time. The employer may establish hours worked on a jobsite for a four (4) ten (10) hour day work week at straight time pay for construction work; the regular working day shall consist of ten (10) hours worked consecutively, between 6:00 a.m. and 6:00 p.m., four (4) days per week, Monday to Thursday, inclusive. Any work performed on Friday, Saturday, Sunday and holidays, and before and after the regular working day on Monday to Thursday where a four (4) ten (10) hour day workweek has been established, will be paid at two times (2) the single time rate of pay. The rate of pay for all work performed on holidays shall be at two times (2) the single time rate of pay.

NO. 33: Means the standard work day and week shall be eight (8) consecutive hours of work between the hours of 6:00 a.m. and 6:00 p.m., excluding the lunch period Monday through Friday, or shall conform to the practice on the job site. Four (4) days at ten (10) hours a day may be worked at straight time, Monday through Friday and need not be consecutive. All overtime, except for Sundays and holidays shall be at the rate of time and one-half (1½). Overtime worked on Sundays and holidays shall be at double (2) time.

NO. 36: Means eight (8) hours shall constitute a work day, Monday through Friday between the hours of 6:00 a.m. and 6:00 p.m. Saturday can be used as a makeup day if time is lost due to weather. All hours in excess of the regular forty (40) hour work week or eight (8) hours per day shall be considered overtime and shall be paid for at the rate of one and one-half (1½) times the regular rate. Employees will be paid at the rate of one and one-half (1½) times their regular rate for work performed on Saturdays. Sundays and holidays worked are to be paid at double (2) the regular hourly rate. Four (4) ten-hour days, at the option of the Employer, shall be the standard work week, consisting of a consecutive ten-hour period, Monday through Thursday or Tuesday through Friday, between the hours of 6:00 a.m. and 6:00 p.m. Forty (40) hours per week shall constitute a week's work.

**REPLACEMENT PAGE
CHRISTIAN COUNTY
BUILDING CONSTRUCTION OVERTIME SCHEDULE**

NO. 48: Means the regularly scheduled work week shall be five (5) consecutive days, Monday through Friday or Tuesday through Saturday. Eight (8) hours shall constitute a day's work. Starting time shall not be earlier than 7:00 a.m. nor later than 10:00 a.m. Forty (40) hours shall constitute a week's work. Overtime at the rate of time and one-half (1½) will be paid for all work in excess of forty (40) hours in any one work week. On the Monday through Friday schedule, all work performed on Saturday will be time and one-half (1½) unless time has been lost during the week, in which case Saturday will be a make up day to the extent of the lost time. On the Tuesday through Saturday schedule, all work performed on Monday will be time and one-half (1½) unless time has been lost during the week, in which case Monday will be a make-up day to the extent of the lost time. Any work performed on Sunday will be double (2) time. If employees work on any of the recognized holidays, they shall be paid time and one-half (1½) their regular rate of pay for all hours worked.

NO. 50: Means eight (8) hours constitute a normal day's work Monday through Friday. Any time worked over eight (8) hours will normally be paid at time and one-half (1½) except for exclusions stated in some following additional sentences. The Employer, at his discretion, may start the work day between 6:00 a.m. and 9:00 a.m. Any schedule chosen shall be started at the beginning of the work week (Monday) and used for at least five days. Work may be scheduled on a four (4) days a week (Monday through Thursday) at ten (10) hours a day schedule. If such a schedule is employed, then Friday may be used as a make-up day when time is lost due to inclement weather. Time and one-half (1½) shall be paid for any work in excess of eight (8) hours in any regular work day Monday through Friday unless working 4-10's, then time and one-half (1½) after ten (10) hours. All work performed on Saturday will be time and one-half (1½). Double (2) time shall be paid for all work on Sundays and recognized holidays.

NO. 57: Means eight (8) hours per day shall constitute a day's work and forty (40) hours per week, Monday through Friday, shall constitute a week's work. The regular starting time shall be 8:00 a.m. If a second or third shift is used, the regular starting time of the second shift shall be 4:30 p.m. and the regular starting period for the third shift shall be 12:30 a.m. These times may be adjusted by the employer. The day shift shall work a regular eight (8) hours shift as outlined above. Employees working a second shift shall receive an additional \$0.25 above the regular hourly rate and perform seven and one-half (7½) hours work for eight (8) hours pay. Third shift employees shall be paid an additional \$0.50 above the regular hourly rate and work seven (7) hours for eight (8) hours pay. When circumstances warrant, the Employer may change the regular workweek to four (4) ten-hour days at the regular time rate of pay. All time worked before and after the established workday of eight (8) hours, Monday through Friday, and all time worked on Saturday shall be paid at the rate of time and one-half (1½) except in cases where work is part of an employee's regular Friday shift. All time worked on Sunday and recognized holidays shall be paid at the double (2) time rate of pay except in cases where work is part of an employee's previous day's shift. For all overtime hours worked \$25.65 of the fringe benefits portion of the prevailing wage shall be paid at the same overtime rate at which the cash portion of the prevailing wage is to be paid. The remaining \$1.29 of the fringe benefit portion of the prevailing wage may be paid at straight time.

NO. 61: Means except as herein provided, eight (8) hours a day, 8:00 a.m. to 4:30 p.m., shall constitute a standard work day, and forty (40) hours per week shall constitute a week's work. The regular workday starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. All time worked outside of the standard work day and on Saturday shall be classified as overtime and paid the rate of time and one-half (1½). All time worked on Sunday and holidays shall be classified as overtime and paid at the rate of double (2) time. The Employer has the option of working either five (5) eight-hour days or four (4) ten-hour days to constitute a normal forty (40) hour work week. When the four (4) day ten hour work week is in effect, the standard work week shall consist of forty (40) hours, Monday through Friday, which will consist of any four (4) consecutive ten-hour four days within the five (5) day period. In the event the job is down for any reason beyond the control of the Employer, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day, straight time not to exceed ten (10) hours per day, or forty (40) hours per week. When the five (5) day eight-hour work week is in effect, forty (40) hours per week shall constitute a week's work (normal work week being Monday through Friday). In the event the job is down for any reason beyond the control of the Employer, then Saturday may, at the option of the Employer, be worked as a make-up day, at straight time not to exceed eight (8) hours for that day, or forty (40) hours per week. A make-up day is not to be used to make up time lost due to recognized holidays.

**REPLACEMENT PAGE
CHRISTIAN COUNTY
BUILDING CONSTRUCTION OVERTIME SCHEDULE**

NO. 64: Means eight (8) hours shall constitute a day's work beginning at 8:00 a.m. and ending at 4:30 p.m. Forty (40) hours shall constitute a week's work, Sunday through Saturday. In the event time is lost due to weather or conditions beyond the control of the Employer, the Employer may schedule work on Saturday at straight time. All work over eight (8) hours in one day, forty (40) hours in one week, or on Saturday (except as herein provided) shall be classified as overtime and be paid at the rate of time and one-half (1½). All work on Sunday or recognized holidays shall be classified as overtime and be paid at the rate of double (2) time. When the four (4) day ten-hour work week is in effect, the standard work day shall be consecutive ten (10) hour periods. Forty (40) hours per week shall constitute a week's work Sunday through Saturday inclusive. In the event the job is down for reasons beyond the contractor's control, then Friday and/or Saturday may, at the option of the Employer be worked as a make-up day, straight time not to exceed ten (10) hours per day or forty (40) hours per week.

NO. 84: The regular working starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. Except as provided in this Article, eight (8) hours a day shall constitute a standard work day and forty (40) hours per week shall constitute a week's work, which shall begin on Sunday and end on Saturday. All time worked outside of the standard work day and on Saturday shall be classified as overtime and paid at the rate of time & one-half (1½) (except as herein provided). All time worked on Sunday and recognized holidays shall be classified as overtime and paid at the rate of double (2) time. The Employer has the option of working either five (5) eight-hour days or four (4) ten-hour days to constitute a normal forty (40) hour work week. When the four (4) ten-hour work week is in effect, the standard work day shall be consecutive ten (10) hour periods, exclusive of the lunch period, beginning at 6:30 a.m. and forty (40) hours per week shall constitute a week's work, Monday through Thursday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day, straight time not to exceed ten (10) hours or forty (40) hours per week. When the five (5) eight-hour work week is in effect, forty (40) hours per week shall constitute a week's work, Monday through Friday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Saturday may, at the option of the Employer, be worked as a make-up day, straight time not to exceed eight (8) hours or forty (40) hours per week.

NO. 98: Means eight (8) hours a day shall constitute a standard work day, and forty (40) hours per week shall constitute a week's work which shall begin on Sunday and end on Saturday. All time worked outside of the standard work day and on Saturday shall be classified as overtime and paid the rate of time and one-half (1½) (except as herein provided). All time worked on Sunday and recognized holidays shall be classified as overtime and paid at the rate of double (2) time. The Employer has the option of working either five (5) eight-hour days or four (4) ten-hour days to constitute a normal forty (40) hour work week. When the four (4) ten-hour work week is in effect, the standard work day shall be consecutive ten (10) hour periods between the hours of 5:30 and 6:30 a.m. and 6:30 p.m. Forty (40) hours per week shall constitute a week's work, Monday through Thursday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed ten (10) hours per day or forty (40) hours per week. When the five (5) day eight (8) hours work week is in effect forty (40) hours per week shall constitute a week's work, Monday through Friday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed eight (8) hours per day or forty (40) hours per week. When the five (5) day eight (8) hour work week is in effect, starting time shall be between 7:00 a.m. and 8:00 a.m. All time worked before 7:00 a.m. shall be paid for at the rate of time and one-half (1½). All work performed on Saturday up to 6:00 p.m. (except as herein provided) shall be compensated for at the rate of time and one-half (1½). All time worked from 6:00 p.m. Saturday to 7:00 a.m. Monday will be paid for at the rate of double (2) time.

NO. 112: Means the regular starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. Except as provided for, eight (8) hours a day shall constitute a standard work day, and forty (40) hours per week shall constitute a week's work, which shall begin on Sunday and end on Saturday. All time worked outside of the standard work day and on Saturday shall be classified as overtime and paid the rate of time and one-half (1½) (except as herein provided). All time worked on Sunday and recognized holidays shall be classified as overtime and paid at the rate of double (2) time. The Employer has the option of working either five (5) eight (8) hour days or four (4) ten (10) hour days to constitute a normal forty (40) hour work week. When the four (4) ten-hour work week is in effect, the standard work day shall be consecutive ten hour periods between the hours of 6:30 a.m. and 6:30 p.m. Forty (40) hours per week shall constitute a week's work, Monday through Thursday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed eight (8) hours or forty (40) hours per week.

**REPLACEMENT PAGE
CHRISTIAN COUNTY
BUILDING CONSTRUCTION OVERTIME SCHEDULE**

NO. 123: Means except as provided, eight (8) hours a day (8:00 A.M. to 4:30 P.M.) shall constitute a standard work day, excluding the 30-minute lunch period, and forty (40) hours per week shall constitute a week's work. All time worked outside of the standard work day and on Saturday shall be classified as overtime and paid the rate of time and one-half (except as herein provided). All time worked on Sunday and herein named holidays shall be classified as overtime and paid at the rate of double time. The Employer has the option of working either five (5) eight-hour days or four (4) ten-hour days to constitute a normal forty (40) hour work week. When the four (4) day ten-hour work week is in effect, the standard work week shall consist of forty (40) hours, Monday through Friday, which will consist of any four (4) consecutive ten (10) hour days within the five day period. In the event the job is down for any reason beyond the control of the Employer, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day, straight time not to exceed ten (10) hours or forty (40) hours per week. Starting time will be designated by the Employer. When the five (5) day eight (8) hour work week is in effect forty (40) hours per week will constitute a week's work (normal work week being Monday through Friday). In the event the job is down for any reason beyond the control of the Employer, then Saturday may, at the option of the Employer, be worked as a make-up day; at straight time not to exceed eight (8) hours or forty (40) hours per week.

NO. 124: Means eight (8) hours shall constitute a day's work on all classes of work between the hours of 6:00 a.m. and 5:30 p.m., Monday through Friday. The pay for time worked during these hours shall be at the regular wage rate. The regular workweek shall be Monday through Friday. Employment from 4:30 p.m. to 12:00 midnight, Monday through Friday, shall be paid for at one and one-half (1½) times the regular hourly rate. From 12:00 midnight until 8:00 a.m. on any day shall be paid for at twice the regular hourly rate. All time worked on Sundays and the recognized holidays shall be paid at the rate of double (2) time. It is understood that forty (40) hours shall constitute a regular workweek, (5-8's) Sunday Midnight through Friday Midnight, understanding anything over eight (8) hours is one and one-half (1½) times the hourly wage rate.

NO. 125: Eight (8) hours of work between the hours of 8:00 a.m. and 4:30 p.m. shall constitute a work day. Forty (40) hours within the five (5) days, Monday through Friday inclusive, shall constitute the work week. Starting time may be adjusted not to exceed two (2) hours. Work performed outside of the aforementioned will be paid at the applicable overtime rate. When starting time has been adjusted, all other provisions concerning the work day shall be adjusted accordingly. The overtime rate of pay shall be one and one-half (1½) times the regular rate of wages, other than on Sundays, holidays and from Midnight until 6:00 a.m., which will be paid at double (2) the straight time rate.

CHRISTIAN COUNTY HOLIDAY SCHEDULE – BUILDING CONSTRUCTION

NO. 1: All work done on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day shall be paid at the rate of double time. When one of the above holidays falls on Sunday, the following Monday shall be observed. When one of the above holidays falls on Saturday the preceding Friday shall be observed.

NO. 2: All work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day, or the days observed as such, shall be paid at the double time rate of pay.

NO. 4: All work done on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas Day shall be paid at the double time rate of pay. If any of the above holidays fall on Sunday, Monday will be observed as the recognized holiday. If any of the above holidays fall on Saturday, Friday will be observed as the recognized holiday.

NO. 7: The following days are assigned days and are recognized as holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. If a holiday falls on a Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This is applied to protect Labor Day. When a holiday falls during the normal workweek, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week. However, no reimbursement for these eight (8) hours is to be paid to the workman unless worked. If workman are required to work the above enumerated holidays or days observed as such, or on Sunday, they shall receive double (2) the regular rate of pay for such work.

NO. 14: The following days are recognized Holidays: Memorial Day, Fourth of July, Thanksgiving Day, Christmas Day, and New Year's Day. No work shall be done on Labor Day. When falling on a Sunday and the following Monday is observed as part of the holiday, then that Monday shall be considered a holiday. Sunday and Holidays will be paid at the rate of two (2) times the regular rate of pay.

NO. 19: All work done on New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, and Christmas Day shall be paid at the double time rate of pay. The employee may take off Friday following Thanksgiving Day. However, the employee shall notify his or her Foreman, General Foreman or Superintendent on the Wednesday preceding Thanksgiving Day. When one of the above holidays falls on Sunday, the following Monday shall be considered a holiday and all work performed on either day shall be at the double (2) time rate. When one of the holidays falls on Saturday, the preceding Friday shall be considered a holiday and all work performed on either day shall be at the double (2) time rate.

NO. 24: All work done on Christmas Day, Thanksgiving Day, New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Presidential Election Day or days locally observed as such, and Sunday shall be recognized as holidays and paid at the double time rate of pay.

NO. 48: All work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day shall be paid for at double (2) the straight-time rate of pay. Any one of the above-listed holidays falling on Sunday shall be observed on the following Monday and paid for at double (2) the straight-time rate of pay. Any of the above holidays falling on Saturday shall be observed on the previous Friday and paid at double (2) the straight-time rate of pay. Employees working on the Saturday will receive the standard pay for Saturday work.

NO. 49: The following days shall be observed as legal holidays: New Year's Day, Decoration Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day, Employee's birthday and two (2) personal days. The observance of one (1) of the personal days to be limited to the time between December 1 and March 1 of the following year. If any of these holidays fall on Sunday, the following Monday will be observed as the holiday and if any of these holidays fall on Saturday, the preceding Friday will be observed as the holiday. If employees work on any of these holidays they shall be paid time & one-half (1½) their regular rate of pay for all hours worked.

NO. 52: All work performed on Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day shall receive the double (2) time rate of pay.

**CHRISTIAN COUNTY
HOLIDAY SCHEDULE – BUILDING CONSTRUCTION**

NO. 54: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day shall be paid at the double (2) time rate of pay. When a holiday falls on Saturday, it shall be observed on Friday. When a holiday falls on Sunday, it shall be observed on Monday.

NO. 65: Work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day, or days celebrated as such, shall be paid at the double time rate of pay. If the holiday falls on Saturday, it will be observed on Friday; if the holiday falls on Sunday, it will be observed on Monday, and shall be paid for at double (2) the regular straight time rate of pay.

NO. 74: All work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day, shall be paid at double (2) time of the hourly rate of pay. In the event one of the above holiday's falls on Saturday, the holiday shall be celebrated on Saturday. If the holiday falls on Sunday, the holiday will be celebrated on Monday.

NO. 78: The following days shall be recognized as holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas. If any of the above holidays fall on Sunday, Monday will be observed as the legal holiday. If any of the above holidays fall on Saturday, Friday will be observed as the legal holiday. All time worked on Sunday and herein named holidays shall be classified as overtime and paid at the rate of double time.

OCCUPATIONAL TITLE	* Date of Increase	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits
Carpenter	6/15	\$28.64	23	16	\$15.55
Electrician (Outside-Line Construction/Lineman)	10/15	\$41.52	18	24	\$5.00 + 34.5%
Lineman Operator	10/15	\$38.37	18	24	\$5.00 + 34.5%
Lineman - Tree Trimmer	10/15	\$21.64	31	30	\$5.00 + 27.5%
Groundman	10/15	\$26.76	18	24	\$5.00 + 34.5%
Groundman - Tree Trimmer	10/15	\$17.50	31	30	\$5.00 + 27.5%
Laborer					
General Laborer	6/15	\$23.82	4	18	\$12.31
Skilled Laborer	6/15	\$24.37	4	18	\$12.31
Millwright	6/15	\$28.64	23	16	\$15.55
Operating Engineer					
Group I	6/15	\$30.23	5	15	\$12.84
Group II	6/15	\$29.88	5	15	\$12.84
Group III	6/15	\$29.68	5	15	\$12.84
Group IV	6/15	\$27.63	5	15	\$12.84
Oiler-Driver	6/15	\$27.63	5	15	\$12.84
Pile Driver	6/15	\$28.64	23	16	\$15.55
Traffic Control Service Driver		\$16.35	29	28	\$2.75
Truck Driver-Teamster					
Group I	6/15	\$28.57	12	3	\$12.05
Group II	6/15	\$28.73	12	3	\$12.05
Group III	6/15	\$28.72	12	3	\$12.05
Group IV	6/15	\$28.84	12	3	\$12.05

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate sheet.

**REPLACEMENT PAGE
CHRISTIAN COUNTY
OVERTIME SCHEDULE - HEAVY CONSTRUCTION**

FED: Minimum requirement per Fair Labor Standards Act means time and one-half (1 ½) shall be paid for all work in excess of forty (40) hours per work week.

NO. 4: Means a regular work week shall consist of not more than forty (40) hours of work, Monday through Saturday, and all work performed over and above ten (10) hours per day and forty (40) hours per week shall be paid at the rate of time & one-half (1½). Workers shall receive time and one-half (1½) for all work performed on Sundays and holidays. A work day is to begin between 6:00 a.m. and 9:00 a.m. at the option of the Employer except when inclement weather or other conditions beyond the reasonable control of the Employer prevent work, in which event, the starting time may be delayed, but not later than 12:00 noon. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward a forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid to the worker(s) unless worked.

NO. 5: Means a regular work week shall consist of not more than forty (40) hours work, Monday through Saturday, and all work performed over and above ten (10) hours per day and forty (40) hours per week shall be paid at the rate of time & one-half (1½). Workmen shall receive time and one-half (1½) for all work performed on Sundays and recognized holidays or days observed as such. Double (2) time shall be paid for work on Sunday or recognized holidays when and only if any other craft employees of the same employer at work on that same job site are receiving double (2) time pay for that Sunday or holiday. If a job can't work forty (40) hours, Monday through Saturday, because of inclement weather or other conditions beyond the control of the Employer, Friday and Saturday may be worked as make up days at straight time (if working 4-10's). Saturday may be worked as a make up day at straight time (if working 5-8's). Make up days shall not be utilized for days lost to holidays. A work day is to begin between 6:00 a.m. and 9:00 a.m. at the option of the Employer except when inclement weather or other conditions beyond the reasonable control of the Employer, including requirements of the owner, prevent work. In such event the starting time may be delayed but not later than 12:00 noon. Where one of the holidays falls or is observed during the work week, then all work performed over and above thirty-two (32) hours shall be paid at time & one-half (1½).

NO. 12: Means a regular work week shall consist of not more than forty (40) hours of work and all work performed over and above ten (10) hours per day and forty (40) hours per week shall be paid at the rate of time & one-half (1½). A workday is to begin between 6:00 a.m. and 9:00 a.m. at the option of the Employer except when inclement weather or other conditions beyond the reasonable control of the Employer, in which event, the starting time may be advanced or delayed. Workers shall receive time and one-half (1½) for all work performed on recognized holidays or days observed as such.

NO: 18: Eight (8) hours of work between the hours of 8:00 a.m. and 4:30 p.m. shall constitute a work day. Forty (40) hours within the five (5) days, Monday through Friday inclusive, shall constitute the work week. Starting time may be adjusted not to exceed two (2) hours. Work performed outside of the aforementioned will be paid at the applicable overtime rate. When starting time has been adjusted, all other provisions concerning the work day shall be adjusted accordingly. The overtime rate of pay shall be one and one-half (1½) times the regular rate of wages, other than on Sundays, holidays and from Midnight until 6:00 a.m., which will be paid at double (2) the straight time rate.

**REPLACEMENT PAGE
CHRISTIAN COUNTY
OVERTIME SCHEDULE - HEAVY CONSTRUCTION**

NO. 23: Means the regular workweek shall start on Monday and end on Friday, except where the Employer elects to work Monday through Thursday, (10) hours per day. All work over ten (10) hours in a day or forty (40) hours in a week shall be at the overtime rate of one and one-half (1½) times the regular hourly rate. The regular workday shall be either eight (8) or ten (10) hours. If a job can't work forty (40) hours Monday through Friday because of inclement weather or other conditions beyond the control of the Employer, Friday or Saturday may be worked as a make-up day at straight time (if working 4-10's). Saturday may be worked as a make-up day at straight time (if working 5-8's). An Employer, who is working a four (4) ten (10) hour day work schedule may use Friday as a make-up day when a workday is lost due to a holiday. A workday is to begin at the option of the Employer but not later than 11:00 a.m. except when inclement weather, requirements of the owner or other conditions beyond the reasonable control of the Employer prevent work. Except as worked as a make-up day, time on Saturday shall be worked at one and one-half (1½) times the regular rate. Work performed on Sunday shall be paid at two (2) times the regular rate. Work performed on recognized holidays or days observed as such, shall also be paid at the double (2) time rate of pay. **For all overtime hours worked during the week or on Saturday \$14.55 of the fringe benefits portion of the prevailing wage shall be paid at time and one-half (1½). For all overtime hours worked on Sundays or recognized holidays \$14.55 of the fringe benefits portion of the prevailing wage shall be paid double time. The remaining \$.50 of the fringe benefit portion of the prevailing wage shall be paid at straight time.**

NO. 29: Means the regularly scheduled work week shall be five (5) consecutive days, Monday through Friday or Tuesday through Saturday. Eight (8) hours shall constitute a day's work. Starting time shall not be earlier than 7:00 a.m. nor later than 10:00 a.m. Forty (40) hours shall constitute a week's work. Overtime at the rate of time and one-half (1½) will be paid for all work in excess of forty (40) hours in any one work week. On the Monday through Friday schedule, all work performed on Saturday will be time and one-half (1½) unless time has been lost during the week, in which case Saturday will be a make up day to the extent of the lost time. On the Tuesday through Saturday schedule, all work performed on Monday will be time and one-half (1½) unless time has been lost during the week, in which case Monday will be a make-up day to the extent of the lost time. Any work performed on Sunday will be double (2) time. If employees work on any of the recognized holidays, they shall be paid time and one-half (1½) their regular rate of pay for all hours worked.

NO. 31: Means the overtime rate shall be time and one-half the regular rate for work over forty (40) hours per week. Sundays and Holidays shall be paid at double the straight time rate. All employees performing work on affected properties during or following emergencies shall receive the applicable rate of pay for the first sixteen (16) consecutive hours and all hours worked in excess of sixteen (16) consecutive hours shall be paid at double time until broken by an eight (8) hour rest period. Should an employee be called back to work within two hours of his normal quitting time, the previous hours worked shall count toward the above sixteen (16) hour provision.

**CHRISTIAN COUNTY
HOLIDAY SCHEDULE – HEAVY CONSTRUCTION**

NO. 3: The following days are recognized as holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid to the workmen unless worked. An Employer working a four (4) day, ten (10) hour schedule may use Friday as a make up day when an observed holiday occurs during the work week. Employees have the option to work that make up day. If workmen are required to work the above enumerated holidays, or days observed as such, they shall receive time & one-half (1½) the regular rate of pay for such work.

NO. 15: The following days are recognized as holidays: New Year's Day, Memorial Day, July Fourth, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on Sunday, it shall be observed on the following Monday. If a holiday falls on Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. If workmen are required to work the above enumerated holidays or days observed as such, they shall receive time and one-half (1½) the regular rate of pay for such work. Where one of the holidays specified falls or is observed during the workweek, then all work performed over and above thirty-two (32) hours in that week shall be paid at the rate of time and one-half (1½). Workmen shall receive time and one-half (1 ½) for all work performed on Sundays. Double (2) time shall be paid for work on Sunday or recognized holidays when and only if any other craft employees of the same employer at work on that same job site are receiving double (2) time for that Sunday or holiday.

NO. 16: The following days are recognized as holidays: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on Sunday, it shall be observed on the following Monday. If a holiday falls on Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid to the worker unless worked. If workers are required to work the above recognized holidays or days observed as such, they shall receive double (2) the regular rate of pay for such work.

NO. 18: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day shall be paid at the time and one-half (1½) rate of pay. If a holiday falls on Sunday, it shall be observed on the following Monday. If a holiday falls on Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward a forty (40) hour week; however no reimbursement for this eight (8) hours is to be paid to the working person(s) unless the holiday is worked.

NO. 24: Work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day, or days celebrated as such, shall be paid at the double time rate of pay. If the holiday falls on Saturday, it will be observed on Friday; if the holiday falls on Sunday, it will be observed on Monday, and shall be paid for at double (2) the regular straight time rate of pay.

NO. 28: The following days shall be observed as legal holidays: New Year's Day, Decoration Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day, Employee's birthday and two (2) personal days. The observance of one (1) of the personal days to be limited to the time between December 1 and March 1 of the following year. If any of these holidays fall on Sunday, the following Monday will be observed as the holiday and if any of these holidays fall on Saturday, the preceding Friday will be observed as the holiday. If employees work on any of these holidays they shall be paid time & one-half (1½) their regular rate of pay for all hours worked.

NO. 30: All work performed on New Year's Day, Decoration Day, Fourth of July, Labor Day, Christmas Day, Thanksgiving Day and Day after Thanksgiving or days celebrated for the same.

SECTION 00430 - PREVAILING WAGE DETERMINATION

PART 1 - GENERAL

- 1.1 The minimum prevailing wage rates as determined by Missouri Division of Labor Annual Wage Order No. 22 (Christian County) shall be paid.
- 1.2 Contractor must pay employee wages equal to or greater than the benefits as outlined in the established Prevailing Wage Scale above. Contractor shall be required to submit Certified Payroll information with each periodic Application for Payment in addition to Final Payroll Affidavit forms.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 00430

SECTION 00440 – E-VERIFY AFFIDAVIT

Project Name: Ozarks Technical Community College Richwood Valley Campus FEMA Shelter Infill

Architect's Project Number **15088**

Date of Documents:

April 27, 2016

Contractor _____,
being first duly sworn, deposes and says that he/she is _____ of
_____ (sole owner, a partner, president, secretary, etc) the
party making the foregoing Bid is a participating Employer in the Department of Homeland Security (DHS)
E-Verify program for Employment Verification . The Bidder has full understanding of the requirements set
forth in the E-Verify Memorandum of Understanding (MOU), and the Bidder does not knowingly employ
illegal aliens. Upon award of Bid and at the Contract Execution, the successful Bidder shall provide
Ozarks Technical Community College with the following documentation:

1. E-Verify Memorandum of Understanding (MOU)
2. E-Verify Company Profile Page

Signed:

Contractor

Title

Address

Company ID Number

State of

County of

On this _____ day of _____ in the year _____, before me, the undersigned notary public,
personally appeared _____, known to me to be the person(s) whose name(s) is/are subscribed
to the within instrument and acknowledged that he/she/they executed the same for the purposes therein
contained. In witness whereof, I hereunto set my hand and official seal.

Seal of Notary:

Notary Public

SECTION 00480 - NON-COLLUSION AFFIDAVIT

Project Name: Ozarks Technical Community College Richwood Valley Campus FEMA Shelter Infill

Architect's Project Number **15088**

Date of Documents:

April 27, 2016

Contractor _____

_____, being first duly sworn, deposes and says that he/she is _____ of _____ (sole owner, a partner, president, secretary, etc) the party making the foregoing Bid that such Bid is not made in the interest of behalf of any undisclosed person, partnership, company, association, organization, or corporation; that such Bid is genuine and not collusive or sham that said Bidder has not directly or indirectly induced or solicited any other Bidder to put in a false or sham Bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any Bidder or anyone else to put in a sham Bid, or that any one shall refrain from bidding, that said Bidder has not in any manner, directly or indirectly, sought by agreement, communication or conference with any one to fix the Bid price of said Bidder or any of other Bidder, or to fix any overhead, profit, or cost element of such Bid price, or of that of any other Bidder, or to secure any advantage against the Owner awarding the contract to anyone interested in the proposed contract, that all statements contained in such Bid are true, and further, that said Bidder has not, directly or indirectly, submitted his Bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid and will not pay any fee in connection therewith, to any corporation, partnership, company, association, organization, Bid depository, or to any member or agent thereof, or to any other individual except to such person or persons as have a partnership or the financial interest with said Bidder in his general business.

Signed:

Contractor

Title

State of

County of

On this _____ day of _____ in the year _____, before me, the undersigned notary public, personally appeared _____, known to me to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged that he/she/they executed the same for the purposes therein contained. In witness whereof, I hereunto set my hand and official seal.

Seal of Notary:

Notary Public

END OF SECTION 00480

SECTION 00700 - GENERAL CONDITIONS and Contractor/Owner Agreement Form

General Conditions of this construction project is the AIA Document A201, 2007 Edition modified for Ozarks Technical Community College

The Contractor/Owner Agreement Form A101, 2007. All conditions applicable to the Contractor is extended to the subcontractor.

The Contractor/Subcontractor Agreement Form A401 shall be used between Contractor and Subcontractor unless approved otherwise.

SECTION 00800 - SUPPLEMENTARY CONDITIONS

1.1 GENERAL

A. The "General Conditions of the Contract for Construction", See Section 00700; AIA Document A201, Ed.2007 Revised for Ozarks Technical Community College, are the General Conditions for this Project.

B. **Project Delivery Process:** This project is a Competitive bid for General Contractor Project Delivery.

The Agreement Form is: AIA Document A101-2009 STANDARD FORM OF AGREEMENT BETWEEN OWNER AND Contractor.

The Subcontractor bidding and performing the Work under this Contract holds the same requirements as required by the Agreement above.

C. The following Supplements of this Section 00800 modify, delete from, and/or add to the General Conditions.

1. All Articles, or portions thereof, which are not specifically modified, deleted, or superseded hereby, remain in full effect.
2. The General Conditions also may be supplemented elsewhere in the Contract Documents by provisions located in, but not necessarily limited to, Division 1 of the Specifications. See 1.2.4 for priority.

1.2 ARTICLES OF SUPPLEMENTARY CONDITIONS

The following articles modify the General Conditions. Refer to the subparagraphs of the General Conditions to identify the location of the following modifications.

A. Clarify Article 1.1.1:

A.1. The articles in **Invitation to Bid** and the **Bid Form** are not a part of the Contract Documents.

A.2. **The 3D Revit Model** is not a part of the Contract Documents. Refer to Article BB below for clarification regarding the role of the 3D Revit Model for this project.

1.3 Correlation and Intent of the Contract Documents

Add subparagraph 1.2.4:

"1.2.4 In the case of discrepancies in the Contract Documents as they relate to each Subcontractor's Work Category responsibilities, the precedence for resolution of such discrepancies shall be as follows (listed in decreasing order of precedence):

1. ADDENDA
2. SPECIAL CONDITIONS
3. SUPPLEMENTARY CONDITIONS
4. GENERAL CONDITIONS of the CONTRACT for CONSTRUCTION
5. DRAWINGS
6. PROJECT MANUAL & TECHNICAL SPECIFICATIONS (Divisions 1 through 16)

In the case of conflicting requirements, the bidder shall notify the Architect during bidding for clarification by addendum. In the case of a conflict arising, in the absence of bid phase

resolution, the Contractor shall bid the more expensive of the conflicts and give the Architect the option of selecting between the conflicting conditions during the work.”

B. 2.1.General

Subparagraph 2.1.1:

Add Paragraph 2.1.2. Owner’s Employee on the Site.

The position described is to clarify the role and responsibility of the Owner’s Representative (Harlan Hill). The Contractor and each subcontractor shall cooperate with the Owner’s Representative as the Representative works as a resource to assist the Contractor in making the project work flow smoothly.

C. 3.7 Permits Fees and Notices

1. Add the following to subparagraph 3.7.1:

“Permits for construction from the City of Hollister, Mo, in Taney County, may be required. The Owner, through the Owner’s Representative will submit Drawings and Specifications to the appropriate public authorities for review/approval and Building Permit. The Owner will be responsible for all fees for Plan Review and Building Permit. The Owner will pay for all “Tap Fees”.

The owner will pay for fees required by State of Missouri Agencies such as DNR should that be required.

Each subcontractor shall provide the fees for any utility tie in’s to public utilities should that be required in doing their work.

The Owner will pay the cost of the Geotechnical Engineer, Testing, and 3rd party inspections required as a part of the Conditions of the Work and work required during the progress of the project. That testing includes but not limited to: geotechnical investigations and measurements and testing; concrete material testing, structural steel inspection and connection testing, and other tests required herein as third party work. The Contractor shall call for and coordinate the 3rd party testing in conjunction with the Owner and the Owner’s Representative.

The Contractor shall furnish a copy of permits, licenses, and inspection reports to the Owner as they are incurred. All other separate fees for third party electrical, mechanical, and plumbing permits/inspections are to be included in the Contract of each Subcontractor and shall be paid by the Subcontractor except for those included by article 3.14 related to performance failure. Should the Contractor be required to pay unanticipated fees related to the project; the owner will compensate the Contractor for the fees by Change Order Process.

F. 3.4.3. Project Manager and Superintendent

1. Add the following sentence to subparagraph 3.9.3:

"The Superintendent shall be provided by the Contractor and shall not be changed except with the written consent of the Owner, unless the Superintendent proves to be unsatisfactory to the Owner or Contractor and ceases to be in the Contractor’s employ. The Superintendent shall remain on the project throughout the project’s duration, i.e., through Final Completion."

G. 3.10 Project Schedule:

1. Add the following subparagraphs 3.10.4 through 3.10.11:

“3.10.4 Project Schedule: In collaboration with the various subcontractors and within 15

days after award of the contracts, the Contractor shall refine the single network (CPM) plan which integrates all the activities of the Contractor, subcontractors, suppliers, and Owner provided items and equipment which meet the time requirements of Article 8. The schedule shall reflect the Owner's requirements for execution of work during ongoing operations. The sequence of all such work activities shall be determined by the Contractor. The Contractor shall utilize the Critical Path Method (CPM) or other approved method of scheduling to develop the network logic diagrams, computer-produced schedules, and other schedule supporting data as required. The schedule shall be updated on a monthly basis and submitted to the Architect in complete form." This schedule shall be known as "**The Project Schedule**".

- "3.10.5 Monthly progress meetings shall be held at the job site to review and update the Project Schedule. (This should be scheduled the same day as one of the required regular meetings. Provide the services of qualified main office personnel at each such meeting. Each sub-contractor shall provide the services of qualified main office personnel and his field supervisor who shall provide necessary scheduling information and manpower commitments at each progress meeting until completion of his contract. Prior to and in preparation for the monthly progress meetings, the Contractor will "update" the Schedule to reflect the current status of the Project and specifically address those critical areas of concern (as determined by the Schedule "update") where immediate action by the contractors are required. The schedule shall be updated monthly prior to the progress meeting and shall be submitted in its "complete form."
- "3.10.6 The Contractor shall assist the various subcontractors in the expediting of their material and equipment deliveries. Upon request, the sub contractors shall furnish copies of their equipment and material purchase orders complete with scheduled shipping and receiving dates."
- "3.10.7 Whenever it becomes apparent from the monthly "updated" schedule that any activity completion date may not be met, the Contractor shall take some or all of the following actions at no additional cost to the Owner:
- .1 Increase construction manpower in such quantities as will substantially eliminate the backlog of work and put the Project back on schedule.
 - .2 Increase the number of working hours per shift, shifts per working day, work days per week, or the amount of construction equipment, or any combination of the foregoing which will substantially eliminate the backlog of work and put the Project back on schedule.
 - .3 Reschedule activities to achieve maximum practical concurrence of accomplishment of activities and put the Project back on schedule."
- "3.10.80 Based on the Project Schedule, the Contractor shall provide to the Owner a projected "Draw down of Funds" schedule to be used by the Owner in scheduling funds for progress payments.
- "3.10.11 The Contractor shall submit to the Architect and Owner a monthly report. The report shall include:
- Brief narrative of progress
 - Project schedule indicating work behind schedule
 - Photos of work in progress
 - Status of change orders
 - Impending change orders."

H. 3.12 Shop Drawings, Product Data and Samples:

1. Clarify Paragraph 3.12.4.
 - a. Shop drawings may be considered a Contract Document in special approved conditions:
 - i. Fire protection design
 - ii. Tilt up concrete slabs and embedded items
 - iii. Flashings and sheet metal alternatives approved by the architect.
 - iv. Structural steel connections

2. Add the following sentence to Paragraph 3.12.6.

“The Contractor shall mark any specific deviations on shop drawings and submittals from the specified item submitted. Failure to do so shall not relieve the Contractor from responsibilities and intent of the Contract Documents.”

3. Add the following subparagraphs 3.12.11 through 3.12.16:

“3.12.11

Shop Drawings Distribution:

- 1) Architect
- 2) Owner’s Representative
- 3) Contractor
- 4) Subcontractor”

“3.12.12 The Contractor shall submit a schedule of all shop drawings, product data, samples and other submittals required, showing the specification section, drawing reference, specific submittal required, date anticipated for submittal and date requested in order not to delay construction. This schedule shall be referenced to the dates in the Schedule for construction, and shall allow 5 days for each submittal and/or resubmittal as review time by the Architect, their Consultants and the Owner. If and item is on the critical path and necessary to have the review expedited, notify the Architect in advance in writing and an attempt will be made to accommodate the Project Schedule. This Schedule shall be completed and submitted prior to the first request for payment.

“3.12.13 The Architect will not act on shop drawings unless they have been reviewed and stamped approved by the CM and subcontractor.

To avoid delay in the shop drawings process, assure submittals are reviewed and marked approved by Contractor prior to issuing to the Architect.” No extension of time will be allowed for delay due to the timeliness of the Architect to respond or time required negotiating resubmittals.”

“3.12.14 Resubmittals: Corrections or comments made on the shop drawings during this review do not relieve the Contractor and subcontractors from compliance with requirements of the drawings and specifications. This check is for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is solely responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; structuring divisions of labor, and performing his work in a safe, timely, and satisfactory manner. Repeated Resubmittals of the same shop drawing may cause delay.

“3.12.15 The Contractor and subcontractors acknowledge shop drawings as tools of communication. The Contractor/subcontractors shall make no claim for additional compensation for the preparation and submittal of shop drawings resulting from

modifications required in the shop drawings by the Architect, regardless of the cause, including modification of Architect's clarifications, errors or omissions. The Contractor may make claims for additional drawing time when there is a change in scope of work due to Owner adding work which significantly modifies the scope of overall construction.

"3.12.16 Measurements: Before ordering any material or doing any work, the Contractor and each subcontractor shall verify all measurements at the project and shall be responsible for the correctness of same. No extra charge shall be allowed on account of the difference between actual dimensions and the dimensions indicated on the Drawings; any differences which may be found shall be reported to the Architect before proceeding with the work."

J. 4.2 Administration of the Contract

Insert the following at the end of Article 4.2.1:

1. Clarify the Architect is scheduled to visit the site on a monthly basis. Issues arising between site visits shall be dealt with by e-mail or via conference call. Should an interim visit be required it shall be applied to the architects total site visit requirement of the O/A Agreement.
2. Add the following 4.2.4.1. Regarding the architects timely response to Contractor communications:
 - i. The architect allows 5 day turnaround on shop drawings, 15 days if consultant engineers are included in the response. If the Contractor needs more speedy response he shall request that to the architect and negotiate an appropriate schedule in all parties' interest.
 - ii. The architect allows 5 days to respond to e-mail correspondence unless the issue requires the input of a consulting engineer. When the engineer response is required allow 10 days. If a more rapid response is required for a critical item, notify the architect to determine a mutually satisfactory schedule. It is the architect's intent to work closely with the contractor and minimize communication conflicts.
 - iii. All phone instructions by any party must be followed up in writing by e-mail or mail. And distributed to the appropriate communication network.

M. 7.1 Changes in the Work - General

1. Add the following sentence to subparagraph 7.1.1:

"The format for Change Orders shall be Similar to AIA Document G701, Change Order, and latest edition."

2. Add the following to subparagraph 7.1.2.

Minor changes to the work not altering the contract amount or time will be through AIA Form G710 Architect's Supplemental Instruction.

2. Add subparagraphs 7.1.4 and 7.1.5:

It is the intent of these documents to provide for competitive bidding. It is also the intent of these documents to provide the project with the quality of product selected in the referenced model or manufacturer.

"7.1.4 Prior to Bid: Where items of equipment and/or materials are specifically identified herein by a manufacturer's name, model or catalog number, and only such specific items may be used in the Base Bid, unless approved as an acceptable alternative.

. If contractors wish to use items of material or equipment other than those named in their Base Bid, the contractor shall apply in writing to the Architect/Engineer for approval of substitution at least five (5) days prior to opening of bids, submitting with his request for approval complete descriptive and technical data on the items or item he proposes to furnish. Approved equals will be incorporated by addenda.

Approval for changes in Base Bid Specifications will be made by Addendum. No blanket approvals for substitutions will be granted to suppliers, distributors, or subcontractors. Unless request for changes in Base Bid specifications are received and approved prior to the opening of bids as defined above, each successful contractor will be held to furnish specified items under his Base Bid.

Items of equipment of the contractor's choice may be offered as alternates to the items named in the specifications, either in the spaces provided for same in proposal forms, or if no space is provided, on the bidder's letterhead. Alternate proposals must be accompanied by full descriptive and technical data on article proposed, together with statement of amount of addition or deduction from Base Bid, if Alternate is accepted. If a voluntary alternate is proposed which requires the Architect/Engineer to redesign work, the Contractor shall include as a part of that alternate the cost of the A/E redesign work." That cost will be identified and credited to the owner; the architect will be compensated by the owner as a change in the scope of work for that item...

"7.1.5 After Bid: Generally, substitutions will not be allowed after bidding concludes and the project is awarded. In special instances where a substitution may enhance the quality of the work, a substitution may be considered. Comply with the following: To receive consideration after the award of the Contract, requests for substitution must be made in writing to the Architect and must be accompanied by documentary proof of equality or difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed equipment. In case of a difference in price, the Owner shall receive all benefit of the difference in cost involved in any substitution, and the contract altered by Change Order to credit Owner with any savings so obtained."

N. 7.2 Change Orders

1. Add the following to subparagraph 7.2.1:

"7.2.1.4. **Change Orders shall be kept current on a monthly basis.**"

M. 7.3 Construction Change Directives

Generally, CCD's will only be used for "Force account work". That is, an issue when the cost or impact on time created by a claim is challenged by the owner but the work must go forward as to not significantly delay the work.

1. ADD subparagraph 7.3.7.6 to read:

"Pending final determination of cost to the Owner, amounts not in dispute may be included in Applications for Payment. The amount of change to be allowed by the Contractor to the Owner for a change which results in either an increase or decrease in the Contract Sum shall be the actual net cost as confirmed by the Architect, with an allowance for overhead and profit equal to the percentage included in the bid form."

N. Add subparagraph 7.5 : Architect's Supplemental Instructions

Add the Paragraph:

- "7.5.1 The Architect's Supplemental Instructions form is used by the Architect to:
- Communicate a response to the Contractor's "Request for Information",
 - Communicate a clarification of interpretation of the documents,
 - Make required changes to the work that does not impact project cost, time.

- Serve as a pre-change order document to authorize work in order to avoid the formal change order approval process impeding the flow of work. In this instance the ASI must be approved in writing by the owner.

O. 8.1 Time-Definitions

1. Delete subparagraph 8.1.1 and substitute the following subparagraph:

"8.1.1 The Contract Time is the period of time from the Date of signing of the Agreement, to the Date of Final Completion, i.e., the date the Architect authorizes the final pay request."

P. Deleted.

Q. 9.8 Substantial Completion

1. Add the following sentence to subparagraph 9.8.4:

"The form to be submitted shall be Certificate of Substantial Completion AIA Document G704, latest edition.

2. Add subparagraph 9.8.6:

"9.8.6 Release of Waivers and Liens: Neither the final payment nor any part of the retained percentage shall become due until the Contractor delivers to the Owner a complete release of all claims arising out of this contract, whether liens arising out of performance of the contract, claims against Prevailing Wages, or claims whether to persons or property arising out of or related in any manner whatsoever to the Contractor's performance, or receipts in full in lieu thereof, and in either case, an affidavit that so far as he has knowledge or information, the release and receipt include all labor and materials for which a lien could be filed; the Contractor may, if any subcontractor refuses to furnish a release or receipt in full, furnish a bond satisfactory to the Owner, to indemnify him against any lien or claim. If any lien or claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such a lien including all costs and reasonable attorney's fees. Upon the request of the Owner, the Contractor will, at his own expense, by bonding or otherwise, secure the prompt discharge of any lien or claim which may be filed against the property arising out of this contract."

9.10 Final Completion and Final Payment

1. Add subparagraph 9.10.6:

"9.10.6 Construction Documents: Contractor and all Subcontractors shall keep a complete and accurate record of changes or deviations from the Contract Documents and the Shop Drawings indicating the work as actually installed. Changes shall be neatly and correctly shown on the respective portion of the Drawings or the Specifications with appropriate supplementary notes. Deliver these documents directly to the owner.

The records above shall be arranged in order in accordance with the various sections of the Specifications and properly indexed. At the completion of the work, certify that each of the revised prints of the Drawings and Specifications is complete and accurate. Prior to application of final payment, deliver three (3) sets of the record Drawings and Specifications to the Architect and Owner's Representative.

Items to be included in the construction records shall include:

- 1) Depths of various elements of foundation in relation to the established benchmark.
- 2) Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
- 3) Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
- 4) Field changes of dimensions and details.
- 5) Changes made by Change Orders or Field Orders.
- 6) Details not on original Contract Drawings.
- 7) As-built drawings showing all valves, locations served and what they control.

Legibly mark-up each Addendum or Specification section to record:

- 1) Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
- 2) Changes made by Change Orders or Field Orders.
- 3) Other matters not originally specified.
- 4) Schedule of paints, finishes and colors used.

The Contractor shall maintain as record documents the following drawings and information to record changes made after review of the following:

- | | |
|---------------------------------------|----------------------------|
| 1) Roof Structure and roof assemblies | 5) HVAC work |
| 2) Concrete Structure | 6) Electrical work |
| 3) Plumbing and drainage lines | 7) Telecommunications work |
| 4) Water and telephone lines | |

No review or receipt of such records by the Architect or the Owner shall be a waiver of any deviation from the Contract Documents or the Shop Drawings or in any way relieve the Contractor from his responsibility to perform the work in accordance with the Contract Documents.

Contractor shall maintain a complete list of subcontractors with phone numbers, name of foreman in charge, etc.

2. Add subparagraph 9.10.7:

"9.10.7 Final Completion Certified by the Architect for Liquidated Damages: The date of Final Completion is the date the Architect **certifies the Final Pay Request.**"

S. 10.1 Safety Precautions and Programs

3. Add the following to subparagraph 10.1.1:

"The Contractor shall provide the Owner with a copy of his written Accident Prevention Program. That program shall include the plan for managing traffic through the project site, and providing public access to those facilities designated by the owner to be accessible during the construction period.

The Contractor shall hold weekly meetings with all of the subcontractors to monitor compliance with all such programs. Each subcontractor shall hold weekly safety tool box meetings with his employees on site and submit a copy of the minutes of each meeting to the Contractor prior to the next meeting."

T. 10.2 Safety of Persons and Property

1. Add the following to subparagraph 10.2.2:

"Regarding safety, the Contractor shall not wait or expect direction for compliance with all Federal, State and local statutes, rules, regulations and orders. The Contractor shall be responsible for the

payment of all fines levied against the Owner, Architect, or Contractor for deficiencies relating to said Contractor's conduct of his work. The Contractor shall indemnify and hold harmless the Owner and Architect for any damages or liability resulting from any claim made by or on the behalf of any employee of said Contractor relating to the conduct of the work by said Contractor."

2. Add subparagraph 10.2.8 Weather Protection:

“.1 The Contractor shall at all times provide protection against weather-rain, wind, storm, frost or heat, so as to maintain all work, materials, apparatus and fixtures free from injury or damage. At the end of the day's work, all new work that is likely to be damaged shall be covered."

“.2 The Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep the excavation free of water."

“.3 The Contractor shall remove all snow and ice as may be required for the proper protection and/or prosecution of the work."

3. Add subparagraph 10.2.9 Bracing, Shoring and Pumping:

“.1 Temporary shoring, bracing, and scaffolding for construction purposes is the domain of the contractor. The Contractor shall provide all shoring and bracing as required for safety and for the proper execution of the work, and have same removed when the work is completed."

“.2 Operate adequate pumping and bailing equipment necessary to keep excavation, pits trenches and other temporary or permanent parts of the project free of water."

3. Obtain geotechnical engineers approval for earthwork impacted adversely by moisture during site preparation work.

4. Add subparagraph 10.2.10 Damaged Material:

“.1 Any work damaged by failure to provide adequate protection shall be removed and replaced with new work at Contractor s expense."

“.2 Any work damaged on existing property shall be removed and replaced with new work at Contractor's expense."

U. Add article 10.5 Protection and Maintenance of Property:

1. Add Paragraphs 10.7.1 to 10.7.4

"10.7.1 Some known above and underground structures and utilities are shown on the Plans, although others may exist. The locations shown are approximate and do not purport to be absolutely correct. Before starting work, Contractor shall notify all utilities involved and request their cooperation in locating lines in advance of the work. Contractor shall make a reasonable effort to avoid breaking utility lines. The utility company shall be notified immediately should a break occur in a line during construction under this Contract. Any lines so broken by the contractor shall be repaired according to the utility company's standard at-end expense of the contractor.

10.7.2.1.1 Contractor will exercise care to prevent damage to existing paving, sidewalks, utilities, structures, or property adjacent to the construction or storage area. Repair of any

damage to existing facilities resulting from Contractor's operations or from subcontractors shall be at the Contractor's expense.

10.7.2.1.2. Project fencing and barriers: The Contractor is the party responsible for safety and protection within his designated project boundaries. The Contractor is responsible for maintaining gates and controls appropriate to organized Labor requirements. The Contractor shall manage the site, and site barriers to suite all access requirements, by construction labor, owners personnel, owners separate contractors, visitors, project team members and others needing temporary access or passage through the project site.

The size and type of barriers provided are the responsibility of the contractor to determine based on his safety and management scheme. Prior to beginning construction, submit a **Proposed Barrier Plan** that is consistent with the safety plan. The owner shall review the plan and evaluate its appropriateness for the continued educational activities that must remain ongoing.

10.7.3 All trenching, excavation and other construction work shall be made in a manner to cause the least interruption to traffic. Where permits are required of the Contractor to excavate or obstruct public property, he shall in all ways, comply with the provisions or requirements of the proper authorities issuing such permits including, but not limited to, their requirements as to time, notice required, warning devices, and temporary structures required.

10.7.4 The Contractor shall be responsible for the construction site residue (Mud tracking, loose rock etc.) that may constitute an unsafe and hazardous condition beyond the project limits. Contractor shall be responsible for all damages to roads, highways, shoulders, ditches, bridges, structures, culverts and other property caused by him or his subcontractors in transporting materials to or from the site of work, regardless of location of such damage, and shall pay for or replace such damaged property to the satisfaction of the Owner of such property.”

10.7.5 The Contractor shall provide a Waiver of Liability to the Owner for the CM's failure to install and maintain erosion control devises required by agencies having jurisdiction and requirements of the documents.

10.7.6 Firearms: No firearms are allowed on the site at any time.

V.11.1 Contractor's Liability Insurance

Delete subparagraph 11.1.2 and substitute the following:

"11.1.2a The Contractor shall purchase and maintain insurance of the following types of coverage and limits of liability:

The Contractor shall furnish the owner with an original Certificate of Insurance, naming the Owner as additional insured including completed operations and which includes coverage and minimum limits as shown below.

.1 Worker's Compensation - Statutory limits required by state law, including Employer's Liability for a limit of \$1,000,000/\$1,000,000/\$1,000,000.

.2 Comprehensive General Liability – (Occurrence format), (Including Completed Operations, Broad Form Property Damage and Contractual Liability for the indemnification Agreement of this Agreement):

\$2,000,000General Aggregate

\$2,000,000.....Products-Comp/OP AGG
 \$1,000,000.....Personal & Advertising Injury
 \$1,000,000.....Each Occurrence

- .3 Comprehensive Automobile Liability - \$1,000,000Combined Single Limit including any auto, all owned auto's, hired autos & non-hired autos.
- 4. In addition to the above insurance Requirements listed above in 1, 2, and 3 Contractor shall furnish Owner with a Certificate of Insurance which includes coverage and minimum limits as follows: Excess Liability Umbrella with limits of Insurance not less than \$3,000,000 which covers General Liability and Employer's Liability.

11.1.2. B. Coverages written on an occurrence basis shall be maintained without interruption from date of commencement of the Subcontractor's work until date of final payment and termination of any coverage required to be maintained after final payment.

11.1.2.c. Certificates of Insurance acceptable to the Owner shall be filled with the Owner prior to commencement of the Contractor's Work. These certificates and the insurance policies required shall contain a provision that coverage's afforded under the policies will not be cancelled or allowed to expire until at least 30 days prior written notice has been given to the Contractor. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final application for payment as required in Article 12. If any information concerning reduction of coverage is not furnished by the insurer, it shall be furnished by the Contractor with reasonable promptness according to the Contractor's information and belief.

11.1.2.d. Each subcontractor shall furnish to the Contractor satisfactory evidence of insurance required of the Contractor.

11.2.e. Waivers of Subrogation: The Owner and the Contractor and subcontractors waive all rights against (1) each other and any of their subcontractors, agents and employees, each of the other, and (2) the Owner, the Architect, the Architect's consultants, separate contractors and any of their subcontractors, agents, and employees for damages caused by fire, or other perils to the extent covered by insurance under the contract or other insurance applicable to the Work, except such rights as they may have to proceeds of such insurance held by the Owner as fiduciary. The subcontractor shall require of their sub-subcontractors, agents, and employees, by appropriate agreements, similar waivers in favor of the parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damage.

11.1.2. f. Builders Risk:

Builders Risk is provided by the Owner for new work in place, stored material, and property damage.

11.1.2.g. .The Contractor's insurance policies shall name both the Architect and the Owner as additional insured. All insurance policies shall provide that no cancellation of the policy or endorsement shall be effective until the tenth day following the mailing (by certified or registered mail return receipt requested) of written notices of such cancellation to the Architect and to the Owner."

2. Add subparagraph 11.1.4:

"11.1.4 No Subcontractor shall be allowed to continue to work on site after the expiration of full insurance coverage. Contractor partial payments shall be withheld until current Certificates of Insurance are submitted to the Contractor."

W. Deleted.

X. Article 11.5 Performance Bond and Payment Bond

1. Delete subparagraph 11.5.1 and replace with the following:

"11.5.1. The Contractor and each subcontractor shall furnish performance and labor and material payment bonds, each in the amount of 100% of the contract amount. The bonds are to be executed by any acceptable surety company or companies authorized to execute such in the state of Missouri, and be written in favor of the Owner. The bonds furnished shall require the attorney-in-fact who executes the required bonds on behalf of the power of attorney. Bond shall be executed on AIA Standard Form A312, two part, Performance Bond and Labor and Material Payment Bond."

Y ONE YEAR WARRANTY: At the end of paragraph 12.2.2 add:

12.2.2.1 The Contractor warrants to the Owner that all materials and equipment furnished under this contract will be new unless otherwise specified, and that all work will be of good quality, free from faults and defects and in conformance to the requirements, including substitutions not properly approved and authorized, may be considered defective. The warranty shall extend for ONE (1) year after the Substantial Completion date or portions thereof.

Z. INTEREST: Section 13.6 - Remove entire section from contract.

AA. Article 15 Claims and Disputes-Resolution of Claims and Disputes:

1. Subparagraph 15.1.5.2 it is understood by the project schedule that adequate slack has been provided in the schedule for typical annual adverse weather conditions. Therefore, not claim shall be made for adverse weather. Should the Contractor believe weather conditions to become atypical, he can appeal to the owner for fair consideration. The architect will evaluate the claim and determine an appropriate adjustment. The architect's judgment on this issue is final.
2. Subparagraph 15.1.6. Change the first sentence to read The Contractor and Owner waive Claims against each other and the architect for.....
3. Subparagraph 15.2.2. The Architect is the Initial Decision Maker for the project.
4. Subparagraph 15.4.5. Modify the last sentence to read as follows:

".....but subject to non binding mediation and, if the parties fail to resolve their dispute through mediation, they shall resolve it through the court system. There will be no arbitration on this project.

1. Subparagraph 15.4. Arbitration Delete the entire paragraph 15.4. The owner has chosen the decline the Arbitration process.

BB. Clarification of the 3D Revit Model:

1. The 3D Revit Model was incorporated by the Design Team to assist in utilizing a BIM Process in developing the Contract Documents. It is a process tool to develop the documents; **it is not a part of the Contract Documents**. A valuable feature of the process of utilizing the Model is that the 3D Revit Model provides participants the ability to visualize most but not all features, materials, and systems that are included in the Contract Documents in place and in relationship with other systems.
2. The 3D Revit Model is made available to the Contractor and Bidders to assist in visualizing systems and communicating general systems information, in providing the model, there is no guarantee by the designers utilizing the modeling tool that the systems are absolutely accurate, inclusive, or absolutely coordinated. Quantities may vary based on the technology of grouping

- design or programming within the tool. Some manufacturing data is still not available for some systems or models within systems, some systems modeled are generic and non specific; some are intentionally generic to allow competitive bidding or substitution.
3. Any systems or quantities developed from the model shall be done at the Bidders risk; cross checked with requirements of the Contract Documents which are the ultimate reference for intent of the Contract.
 4. The 3D Revit Model will continue to be used as a tool for developing Contract Modifications during the Project. It will be used to create the Modification to the Contract Document, but it is not a Modification to the Document. Modifications are defined in other Articles of the Conditions.
 5. Modifications to the 3D Revit Model: The 3D Revit Model was developed and is managed by the Professional Design Team. If the Contractor, sub contractors, suppliers, or others seeking changes to the model; request the modification through the Architect who will make the modification or direct his consultants to make modifications. **Do not change the Model** unless authorized by the Architect in writing.
 6. It is a goal of the designers that the 3D Revit Model be as accurate as possible in visualizing the Contract Documents, if the Contractor and Bidders become aware of a deviation or discrepancy between what is depicted in the model vs. what is shown and required in the Contract Documents, it is a requirement and condition of the Work that the Contractor communicate that condition to the Architect.

END OF SECTION 00800

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I HEREBY DISCLAIM ANY RESPONSIBILITY FOR PLANS, SPECIFICATIONS OR OTHER DOCUMENTS TO BE USED ON THIS PROJECT NOT PREPARED BY ME.

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SECTION 01010 - SUMMARY OF THE WORK

RELATED DOCUMENTS

Drawings and general provisions of Contract including General and Supplementary General Conditions and other Division 1 Specification Sections apply to this Section. This section is intended to assist the bidders and Contractor, when selected, in understanding the scope of work intended in the documents. Work described herein is for orientation; refer to the Documents for the specific scope of work.

PROJECT DESCRIPTION-GENERAL

The site is located at 10698 Historic Hwy 165 in Hollister, MO in the existing OTC Campus building. The proposed expansion includes an interior frameless storefront system on the ground floor, student services renovations and science lab infill on the 2nd floor, build-out of the 3rd and 4th floor in the areas that are currently not infilled including renovations around the connection points to the existing infilled areas. The scope of work shall include all MEP items as shown in the documents for the applicable spaces.

ACCESSIBILITY STANDARDS AND PROVISIONS FOR THE HANDICAPPED: The project is to comply with the following standards: IBC 2012
American National Standard ICC/ANSI 117/1
Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines 2010 ED. It is a part of this project. (ADAAG)

The designers have endeavored to comply with these standards as the project design has developed. It is required of this contract that the contractor and those trades involved in the execution of the work, and tradesmen familiar with the detail requirements of accessibility, notify the architect of deficiencies, or non compliance should they become aware of the inconsistency.

Nothing in this requirement is intended to extend design responsibility to the constructors and requirement of the Conditions of the contract. Designers are making every effort to have a compliant accessible facility and seek your review and input in achieving it.

Partial owner Occupancy: The Owner reserves the right to limited occupancy during construction. Limited occupancy is directed toward placing and installing equipment in areas of the building, provided that such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of Work. The contractor shall as a part of his work provides coordination and scheduling to allow the owners work, by separate contractors and staff, to be done.

General requirements of this section: The Owner will arrange and pay for delivery of Owner-furnished items. Some owner furnished items are required to be installed by the General Contractor. The Owner Representative will act as owner agent regarding owner furnished items.

The Contractor is responsible for coordinating designated delivery dates of Owner-furnished items in the Contractor's Construction Schedule, The Contractor is responsible for cooperating with all separate contractors, including receiving, unloading, handling, and storage of Owner-furnished items at the site. Should equipment arrive prior to the scheduled delivery date, temporary storage and secondary shipment is the responsibility of the owners separate contractor. The Contractor is responsible for protecting Owner-furnished items from damage as a consequent of operations under this contract, including damage from exposure to the elements, and to repair or replace items damaged as a result of his operations. The owners separate contractors are responsible for removing crates, refuse, cleaning and vacuuming the adjacent floors to acceptable condition after installation. The owners separate contractors are liable for any damage to the building that may occur while delivering, placing, or installing their systems.

OWNER FURNISHED ITEMS TO BE DELIVERED, STORED AND INSTALLED BY OTHERS: IT IS REQUIRED OF THIS CONTRACT TO HOOK UP AND TEST EQUIPMENT: IT IS REQUIRED BY THIS CONTRACT FOR THE CONTRACTOR TO RECEIVE AND INSTALL SOME OWNER PROVIDED ITEMS.

Banners: Decorative Column mounted banners.

Telecommunications Systems: IT Systems: The contractor shall make the telecommunications equipment room available to the Owner a minimum of 60 days prior to Substantial Completion. All cable trays have priority to space after fire protection systems. Please note that the cable tray access to the ceiling has high priority and should be installed early in the project to avoid conflicts with mechanical or electrical systems. This contract will require running low voltage work. Refer to Division 16 for requirements.

Free standing furnishings, Systems walls and modular office systems: The Owner will provide free-standing furniture for office areas, classrooms, and designated public spaces. The Work in this contract includes providing scheduling and coordination of access to spaces for freestanding furniture. Electrical and data hook-ups for all FF&E. This contract requires access to the space for built in modular wall systems and modular office systems. Refer to the documents for extent of this work.

LABORATORY EQUIPMENT: The owner under separate contract, will purchase, have delivered, uncrated, and install laboratory equipment. The extent of Lab equipment is scheduled in the drawings. The contractor shall assist in receiving, temporary storage in the building, and making labs available for installation of lab equipment. The Contractor shall make all electrical and mechanical hook ups, test and verify operability as a part of this work. It is the responsibility of the Contractor to review Lab. Equipment shop drawings and coordinate pre cut and pre punched holes in lab tops to receive plumbing and power requirements, monitor hood vent paths and requirements, for a complete installation. The Contractor shall insure the Work of the Lab. Equipment and the work of the Plumbing, Mech., and Electrical trades are coordinated including coordinating the meshing of owner provided fittings and fixtures with that provided by the Owner. Provide grounding, blocking, furring and fields to receive equipment anchorage to wall system.

ALTERNATES

Alternates are as shown on the drawings and identified in Division 1. Section:01230.

END OF SECTION 01010

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Pre-construction Conference.
 - 2. Progress Meetings.
 - 3. Pre-Installation Meetings.
- B. Construction schedules are specified in another Division-1 Section.

1.3 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 7 days after Notice to Proceed and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments, present project Safety Plan, and coordinate temporary barriers and public access routes, material delivery and drop locations, staging and scheduling.
- B. Attendees: The Owner, Architect, the Contractor and its superintendent, other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: The Agenda is prepared by the Contractor. The Architect will provide topics of concern to the Contractor prior to submitting the Agenda. Discuss items of significance that could affect progress including but not limited to such topics as:
 - 1. Division 1. Requirements such as:
 - Tentative construction schedule- Project Schedule.
 - 2. Procedures for processing field decisions and Change Orders, and structure channels of communication and data distribution for all parties.
 - 3. Procedures for processing Applications for Payment.
 - 4. Distribution of Contract Documents.
 - 5. Submittal of Shop Drawings, Product Data and Samples.
 - 6. Preparation of record documents.
 - 7. Use of the premises, contractors designated parking.
 - 8. Office, Work and storage areas.
 - 9. Equipment deliveries and priorities.
 - 10. Safety procedures, location and types of barriers.
 - 11. Security.
 - 12. Housekeeping.
 - 11. Working hours and conditions.
 - 14. Special Inspections and reports.

1.4 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site. Establish a regular schedule and time for the meeting. Notify the Owner and Architect of scheduled meeting dates. Coordinate one of meeting dates with preparation and process of the payment request.
 - a. End of month Progress Meeting, Change Order Review, and Pay Application review.
 - b. The Architect suggests the mid month progress meeting focuses on progress issues and product pre-installation and coordination.

- B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 2. Review the present and future needs of each entity present, including such items as:
 - a. Time.
 - b. Sequences.
 - c. Deliveries.
 - d. Off-site fabrication problems.
 - e. Access.
 - f. Temporary facilities and services.
 - g. Hazards and risks.
 - h. Housekeeping.
 - i. Quality and Work standards.
 - j. Change Orders.
 - k. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each progress meeting date, the Contractor will generate and distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report. All parties will return annotate the minutes and documents exceptions to the contractor for final distribution. The Architect will annotate in different type color and return to the Contractor for publishing the final report. Submit the final report in a timely manor.
1. Schedule Updating: Revise the construction schedule monthly and prior to the Pay Application.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01200

SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

B. The price for all additive alternates shall be held for a period of 30 days after the date of Contracting to allow the owner the option of bringing the work into the project after project startup. No additional claim for this work will be permitted during that period.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Bid Alternates Schedule:

1. Alternate No.001: All work associated with replacing the boilers in entirety and switching to two larger boilers for the entire campus.

END OF SECTION 01230

SECTION 01250 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this section.

1.2 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
 - 1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
 - 2. Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.
 - 3. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 CHANGES IN THE WORK

- A. **Architect's Supplemental instructions (ASI's)** authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect on AIA form G710, Architect's Supplemental Instructions.
- B. The Architects Supplemental instructions (**ASI**) is also used as a tool for summarizing actions:
 - 1. Both the Architect and the Contractor initiates an issue as an **RFP** (Request for (Proposal)). The contractor will respond, if a claim is anticipated, as a **COR** (Change Order Request). The COR will include a suggested project cost. If no claim is to be made the issue becomes an ASI.

1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. **Owner Initiated Proposal Requests:** (RFP) Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, Change Orders are to be kept up to date and current to allow the owner to monitor the project budget.
 - 1. Proposal requests issued by the Architect are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.
 - 2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
 - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- B. **Contractor-Initiated Change Order Requests:** When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
 - 1. Include a statement outlining the reasons for the change and the effect of the change on the Work within 10 days of occurrence of cause for change. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
 - 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.

1.5 UNIT COST ALLOWANCES (If required)

- A. Allowance Adjustment: Base each Change Order Request for an allowance cost adjustment solely on the difference between the actual purchase amount and the unit cost allowance, multiplied by the final measurement of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Submit substantiation of a change in scope of work claimed in the Change Order Request related to unit-cost allowances.
 - 2. The Owner reserves the right to verify and modify the actual quantity of work-in-place by independent quantity survey, measure, or count.
- B. Claims must be submitted for increased costs within 20 days of the occurrence.

1.6 CONSTRUCTION CHANGE DIRECTIVE (Force Account)

- A. Construction Change Directive (**CCD**): When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the contractor may be required to proceed with the work through the CCD Process. The Architect may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. **Terms will be based on time and material with allowed mark-up.**
 - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
 - 2. Requirements listed below for Change Orders apply to Construction Change Directives in determining changes to the Contract Sum or Time.
 - 3. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 4. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
 - 5. Ultimately the CCD becomes a Change Order.

1.7 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Request, the Architect will issue a Change Order for signatures of the Owner and Contractor on AIA Form G701, as provided in the Conditions of the Contract. To allow for timely decisions affecting work, the COR's are typically processed in weekly intervals as needed to keep the work flowing smoothly.
- B. Submit a complete itemized list of all material and labor in each proposal for change items as shown by example of attached sample itemized proposal.
- C. Deductive Change Orders shall include costs plus percentages for contractor mark up to be deducted.
- D. Pre-approval of a COR: To accelerate decision making and assure the project proceeds in a timely manner, the Owner may entertain pre approving a Change Order Request. This is essentially a statement by the Owner that a Change Order will be accepted when processed in the future. The approved COR must be signed by the Contractor, Architect, and Owner to become an approved document.

1.8 MAXIMUM ALLOWANCE FOR OVERHEAD AND PROFIT & LABOR BURDEN on Change Orders:

- A. Labor costs per hour shall be included with labor burden identified, which shall not be less than actual labor rate. Identify any labor burden costs over and above the prevailing wage rate. Labor burden costs shall not include overhead and profit charges as identified below.
- B. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: job site office expense, incidental job burdens, truck expense including mileage, small hand tools, project supervision including field supervision, company benefits and general office overhead. Percentages for overhead and profit charged for Change Orders shall be

negotiable and may vary according to the nature, extent and complexity of the work involved. Percentage mark ups provided herein are intended to include the costs associated with all delay, disruption, extended job site presence and home office overhead resulting from the changed work.

C. The maximum allowable Overhead and Profit is a condition of the Contract and shall be as filled in on the bid form similar to the schedule below:

	<u>Profit & Overhead</u>	<u>Not to Exceed</u>
A. To Contractor for work performed by his own forces	_____ %	10%
B. To Contractor for work performed by other than his own forces	_____ %	5%
C. To Subcontractor for work performed by his own forces	_____ %	10%
D. To Subcontractor for work performed by other than his own forces	_____ %	5%

Percentages for overhead and profit will not be allowed on applicable taxes and bond Premiums.

- E. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work. Proposals must show items to be deleted, if any, and the cost of the change shall be the result of the net difference to the base contract. Proposals are **not** to be determined by a re-bid of the entire scope of work except where changes significantly alter the entire scope of a particular trade.
- F. The percentages for overhead and profit credit to the Owner on Change Orders that are solely decreases in the quantity of work or materials may be negotiated and may vary according to the nature, extent and complexity of the work involved, but in no case shall be less than ten percent (10%).
- G. Change Orders shall be kept current within the month of the incident leading to the claim.

1.9 Submit a complete itemized list of all material and labor in each proposal for change items as shown by example of attached sample itemized proposal.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 - SAMPLE SHEET (ATTACHED).

PART 4 - SAMPLE

SAMPLE PRICING SHEET

Project:	Sprinkler Modification for XYZ Company	Date:	April 1, 2015
Location:	Hollister, Missouri	Estimator:	Joe Smith
Labor Rate:	\$27.00		

Material	Units	Unit Measure	Material Per Unit	Man Hours Per Unit	Total Man Hrs.	Material Total
6" Tee	1	each	\$45.00	2.000	2.0	\$ 45.00
less 6" ell	1	each	\$30.00	0.000	0.0	30.00
6" sch 40 pipe	15	feet	\$10.43	0.253	3.8	156.45
6" cap	1	each	\$11.00	1.500	1.5	11.00
6" hanger	1	each	\$12.00	0.400	0.4	12.00
4" saddle weld	1	each	\$ 0.00	1.200	1.2	0.00
4" sch 40	18	feet	\$ 4.44	0.183	3.3	79.92
4" ell	3	each	\$13.39	2.000	6.0	40.17
4" hanger	3	each	\$ 8.00	0.300	0.9	24.00
4" weld	1	each	\$ 3.00	1.000	1.0	3.00
1-1/2" cond sch 80	21	feet	\$ 1.63	0.080	1.7	34.23
1-1/2" ell	3	each	\$ 4.00	0.400	1.2	12.00
1-1/2" tee	1	each	\$ 5.00	0.600	0.6	5.00
1-1/2" weld	1	each	\$ 3.00	0.400	0.4	3.00
3/4" F & T trap	1	each	\$73.00	0.500	0.5	73.00
3/4" strainer	1	each	\$12.00	0.500	0.5	12.00
3/4" XH nipples	4	each	\$ 7.70	0.100	0.4	30.80
3/4" unions	2	each	\$ 3.18	0.300	0.6	6.36
3/4" cap	1	each	\$ 0.65	0.100	0.1	.65
3/4" pipe sch 80	10	feet	\$ 0.72	0.040	0.4	7.20
3/4" tee	1	each	\$ 1.50	0.300	0.3	1.50
3/4" ell	3	each	\$ 0.95	0.200	0.6	2.85
3/4" hanger	2	each	\$ 2.50	0.200	<u>0.4</u>	<u>5.00</u>
SUBTOTAL					28.4	
\$ 618.47						
SALES TAX (if applicable)					6.125%	37.88
LABOR 28.4 MH						\$27.00
<u>765.96</u>						
SUBTOTAL						\$1422.31
10% OVERHEAD AND PROFIT						<u>142.23</u>
TOTAL						\$1,564.54

END OF SECTION 01250

SECTION 01290 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than five (5) days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub schedules: Where the Work is separated into phases requiring separately phased payments, provide subs schedules showing values correlated with each phase of payment. Retain paragraph and subparagraphs below. Revise to suit Project. If desired, include a sample schedule of values at end of Section.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.

- c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and Owner's Representative and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

- B. Payment Application Times: The date for each progress payment is indicated in the Agreement and the Progress Payment Schedule below.

Progress Payment Schedule:

25th of month:	Subcontractor Pay Application due to tractor Co
1st of following month:	Contractor Pay Application Due to Architect
7th of the month:	Architect submits Pay Application to Owner.
28 th of Month	Contractor distributes payments.
10 days after receipt Of Owner's Payment	Contractor to pay Subcontractors

- C. First Application for Payment may be submitted without lien Wavers. Subsequent Applications for Payment must be accompanied by lien waivers from the Contractor and his subcontractors, sub-subcontractors, and suppliers, for the principal portions of the work, amounting to one hundred percent (100%) of the payment that was paid to the Contractor for previous calendar month.
- D. Retention. The Owner shall retain ten (10%) as Retention.
- E. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.
- F. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Owner's Representative will return incomplete applications for re-submittal.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- G. Transmittal: Submit 4 signed and notarized original copies of each Application for Payment to Architect by means ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors.

2. Schedule of Values.
 3. Contractor's Construction Schedule.
 4. List of principal suppliers and fabricators
 5. Products list.
 6. Schedule of unit prices.
 7. Submittals Schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire Owner's insurance.
 17. Preliminary payment schedule.
- J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete. See Section 01770 for limitation of number of inspections and related pay applications.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 3. Include a Summary List of **all** Subcontractors, material suppliers, and other entities that have received payments during the Work. Provide final amounts paid and check off verification that waivers, lien releases, and current Prevailing Wage Rates have been fulfilled. The Affidavit shall be signed by the CM.
- K. Administrative actions and submittals that shall proceed or coincide with this application include:
1. Warranties (guarantees) and maintenance agreements.
 2. Maintenance instructions.
 3. Application for reduction of retainage.
 4. Advice on shifting insurance coverages.
 5. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- L. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that all claims have been settled.

8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Conservation.
 - 3. Coordination Drawings.
 - 4. Administrative and supervisory personnel.
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Summary of the Work" for an Owner-approved description of the division of Work among separate contracts and responsibility for coordination activities not in this Section.
 - 2. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

- C. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
 - 1. Indicate relationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Refer to Division 15 Section "Basic Mechanical Materials and Methods" and Division 16 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.
- B. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
 - 1. Include special personnel required for coordination of operations with other contractors.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes utilization of a web based platform: **A360** as the tool for administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals. See Supplemental General Conditions.

- B. **ELECTRONIC SUBMITTAL PROCEDURES**

- A. Summary:

- 1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format. Access to A360 will be provided by the Architect at the start of the project.
 - 2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
 - 3. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

- B. Procedures:

- 1. Submittal Preparation - Contractor may use any or all of the following options:
 - a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the A360 website.
 - b. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
 - c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
 - 2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
 - 3. Contractor shall transmit each submittal to Architect using the A360 website.
 - 4. Architect / Engineer review comments will be made available on the A360 website for downloading. Contractor will receive email notice of completed review.
 - 5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.

- 1. Internet Service and Equipment Requirements:

- a. Email address and Internet access at Contractor's main office.
 - b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's or Owner's Representative's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect and Engineer for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
 - 1. Initial Review: Allow 5 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 15 days for initial review of each submittal.
 - 3. Special Speed Submittal Processing: A special appeal in writing may be made to the Architect to expedite a submittal. (This is to speed the ordering or shop drawings process.) The Owner and Contractor agree hastened documents can result in omission and errors. Consequently, each agrees to hold the A/E harmless for lapses and omissions that can occur as a result of accelerated reviews.
 - 4. If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 5. Allow 5 days for processing each resubmittal.
 - 6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Identification: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Owner's Representative.
 - 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.

- c. Name and address of Owner's Representative.
 - d. Name and address of Architect.
 - e. Name and address of Contractor.
 - f. Name and address of subcontractor.
 - g. Name and address of supplier.
 - h. Name of manufacturer.
 - i. Unique identifier, including revision number.
 - j. Number and title of appropriate Specification Section.
 - k. Drawing number and detail references, as appropriate.
 - l. Other necessary identification.
- F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect or Owner's Representative observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Owner's Representative.
 2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor. The Contractor must stamp submittals approved prior to review by the Architect.
- I. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction. Refer to Submittal Log for determining Dates of the Final Submittal.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Number of Copies: Submit digital copies of each submittal, unless otherwise indicated to Architect.
 2. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:
 - a. Initial Submittal: Submit a preliminary single copy of each submittal where selection of options, color, pattern, texture, or similar characteristics is required. Architect, through Owner's Representative, will return submittal with options selected.
 - b. Final Submittal: Initial submittal may serve as possible final submittal through digital A360 site. A complete CD with all submittals shall be submitted in conjunction with digital submittals on A360.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Standard product operating and maintenance manuals.
 - j. Compliance with recognized trade association standards.
 - k. Compliance with recognized testing agency standards.
 - l. Application of testing agency labels and seals.
 - m. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
- D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."
- E. Samples: Prepare physical units of materials or products, including the following:
1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
 2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or

containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:
 - a. Generic description of Sample.
 - b. Product name or name of manufacturer.
 - c. Sample source.
 5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
 - a. Size limitations.
 - b. Compliance with recognized standards.
 - c. Availability.
 - d. Delivery time.
 6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
 - a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
 - b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 7. Number of Samples for Initial Selection: Submit two (2) full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 8. Number of Samples for Verification: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
 - a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 9. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.

2. Number and name of room or space.
 3. Location within room or space.
- G. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."
- H. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit digital of each submittal, unless otherwise indicated.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."
- B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

- J. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- M. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.
- N. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- O. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- P. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- Q. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- R. Material Safety Data Sheets: Submit information directly to Owner. If submitted to Architect, Architect will not review this information but will return it with no action taken.

- S. **Special Inspections and Reports:** Refer to Section 00800 Supplementary Conditions for special required inspections and reports required.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
1. Approved as Submitted, Approved as Noted, Disapproved, Revise and Resubmit.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to Owner's Representative for distribution to appropriate party.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

3.3 SCHEDULE OF SUBMITTAL REQUIREMENTS:

- 1) Identify each document, shop drawing and material and equipment list, etc., with the following: Note: To assure adequate clarity to the project delivery process The Architect reserves the right to require additional submittal data on a specification item without an increase in cost to the owner.
 - (a) Type of Document from Coded Legend below (2).
- 2) Coded Legend
 - (a) Shop Drawings
 - (b) Catalog Data
 - (c) Equipment List
 - (d) Material List
 - (e) Elementary Diagrams and Wiring Diagrams
 - (f) Installation Instructions
 - (g) Maintenance Manuals and Instructions
 - (h) Theory of Operation Brochures
 - (i) Samples
 - (j) Performance Curves, Certificates, and Test Data

- (k) Certifications
- (l) Operating Instructions
- (m) Color Samples
- (n) Welder's Certificates
- (o) Recommended Spare Parts List
- (p) Computations
- (q) Special Warranties (list warranty period if greater than one year)
- (r) Spare Parts Availability
- (s) Listing of Species and Grades for each use
- (t) Hardware Schedule

<u>Specification Section</u>	<u>Required Submittals</u>
05400 Cold-Formed Metal Framing	b
05500 Metal Fabrications	a, b
06100 Rough Carpentry	s
06402 Interior Architectural Woodwork	a, b, i
07210 Insulation	b, f
07900 Joint Sealants	b, f, i, k
08110 Steel Doors and Frames	a, b
08211 Wood Doors	a, b, i, q (Life)
08710 Finish Hardware	b, k, t
08800 Glass & Glazing	b, f, k
09260 Gypsum Board Assemblies	a, b, i
09310 Ceramic Tile	a, b, j, m
09510 Acoustical Ceiling	a, b, m
09650 Resilient Flooring	b, m
09680 Carpet Tile	a, b, j, m
09900 Painting	b, m
10100 Visual Display Boards	a
10155 Toilet Partitions	a, b, m
11132 Projection Screens	a, b
15010 HVAC	a, b, c, f, g, l, q
15440 Plumbing	b, l, q
16010 Electrical	a, b, l, q

Special Warranties, Certificates, and Operation and Maintenance Manuals shall be submitted to the Owner's Representative before final payment will be made

END OF SECTION 01330

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. The Contractor bears the sole responsibility for the quality of the work performed.
- C. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- D. Related Sections include the following:
 - 1. Divisions 2 through 16 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

- A. **Quality-Assurance Services:** Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements. The cost of these services is born by the contractor.
- B. **Quality-Control Services:** Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect. The cost of these services are born by the owner.
- C. **Mockups:** Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged. The cost of this service is born by the contractor.

- D. **Testing Agency:** An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency. The cost of these services are born by the owner.
- E. **Special Inspection Services;** Special inspection services are required by IBC Chap. 17. Those service requirements are called out in the Drawings and sections of the specifications. Portions of the services are provided by and integral with activities required by Quality Assurance Services, Quality Control Services, and Testing Agency Services. The contractor shall be required as a part of this contract to assemble the services required within the documents, schedule their implementation, and coordinate the requirements with agencies having jurisdiction on these issues.

1.4 DELEGATED DESIGN

- A. **Performance and Design Criteria:** Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.5 REGULATORY REQUIREMENTS

- A. **Copies of Regulations:** Obtain copies of the following regulations and retain at Project site to be available for reference by parties who have a reasonable need:

1.6 SUBMITTALS

- A. **Qualification Data:** For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. **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 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.
- C. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- D. **Reports:** Prepare and submit certified written reports that include the following:

1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Ambient conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

- G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.
- H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.
1. Contractor responsibilities include the following:
 - a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
 - d. When testing is complete, remove assemblies; do not reuse materials on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. *(Note: The Architect will visit the site one (1) time per month, usually at time of review of pay requests. Schedule mockups to be evaluated at the time of these visits.)*
1. Build mockups in location and of size indicated or, if not indicated, as directed by Owner's Representative.
 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed, unless otherwise indicated.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Owner will engage and pay for the services of a qualified testing agency to perform inspections and tests specified as the Owner's responsibility.
1. Generally Owner Responsible Inspection and testing include:
 - a. Geotechnical services
 - b. Concrete and re-bar related services
 - c. Structural steel and cold for metal framing related services
 - d. Special Inspection requirements including submittals, reports, labeling, and other requirements of the documents.

2. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 3. Costs for retesting and reinspections construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed, or as pre-scheduled.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
1. Testing agency will notify Architect, Owner's Rep, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Testing agency will retest and reinspect corrected work.
- D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- E. Retesting/Reinspections: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspections, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect, Owner's Representative, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 5. Do not perform any duties of Contractor.

- G. Associated Services: The Contractor shall cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field-curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
 8. Scheduling and coordination of the work.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date of issuance of the Notice to Proceed.
1. Distribution: Distribute schedule to Owner, Architect, Owner's Representative, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

- A. Firms approved by the Owner's Representative.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
 2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.

- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400

SECTION 01420 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, hook-up of PME required systems, protecting, cleaning, and similar actions for an operational system.
- H. "Provide": Furnish and install, complete and ready for the intended operational use.
- I. "Installer": Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- J. "Experienced": When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

- K. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. **Such "Industry Standards" are made a part of the Contract Documents by reference.** Interpreting industry standard in the instance of quality and performance within the intent of the documents is the role of the Architect of Record and his Engineering Consultants of Record.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, **comply with the most stringent requirement.** Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
 - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
 - 2. Acceptable levels of Quality and "industry standard": The term "industry standard" as a reference to common practice varies from published or formal "Industry Standards": Conditions may occur during construction that reveals issues of acceptable level of artisans performance and product quality that is not covered by Industry Standard. Work that is performed without published standards of reference is referred to as "industry standard" (lower case). In such an instance, it refers to performance quality of similar work done by similar artisans with similar capabilities, in similar conditions within the same region. (It is often an issue regarding acceptability of material finish). The requirement for better than minimum performance, to meeting and exceed a minimum "industry standard" for acceptability, is embedded in the "intent of the documents" prepared by the Architect. The Architect is the sole judge of the intent of his documents. In the making value judgments the Architect refers initially to the Documents, to code and agency requirements, then to formal Industry Standards, and as a last resort, local industry standard of practices. The Contractor and Owner jointly agree this process is complex and often subjective and agree to accept the Architect's decision as final according the AIA 210, Article.4.2.
- D. Copies of Standards: Each Contractor and subcontractor engaged in construction delivery on the Project must be familiar with "Industry Standards" and local standards applicable to its construction activity. Copies of applicable Standards are not bound with the Contract Documents.
 - 1. Where copies of Standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.

- E. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-5434
CFR	Code of Federal Regulations Available from Government Printing Office www.access.gpo.gov/nara/cfr	(888) 293-6498 (202) 512-1530
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterways Experiment Station www.wes.army.mil	(601) 634-2355
DOD	Department of Defense Specifications and Standards Available from Defense Automated Printing Service //astimage.daps.dla.mil/online	(215) 697-6257
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Defense Automated Printing Service //astimage.daps.dla.mil/online	(215) 697-6257
	Available from General Services Administration www.fss.gsa.gov/pub/fed-specs.cfm	(202) 619-8925
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MILSPEC	Military Specification and Standards Available from Defense Automated Printing Service //astimage.daps.dla.mil/online	(215) 697-6257
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-5434

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale

Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AAN	American Association of Nurserymen (See ANLA)	
AASHTO	American Association of State Highway and Transportation Officials www.aashto.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute/ACI International www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
ADC	Air Diffusion Council www.flexibleduct.org	(312) 201-0101
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AFPA	American Forest & Paper Association (See AF&PA)	
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000

AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association www.ahardbd.org	(847) 934-8800
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.e-architect.com	(202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALA	American Laminators Association (See LMA)	
ALCA	Associated Landscape Contractors of America www.alca.org	(800) 395-2522 (703) 736-9666
ALSC	American Lumber Standard Committee	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen) www.anla.org	(202) 789-2900
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts www.aosaseed.com	(402) 476-3852
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(941) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute	(703) 524-8800

	www.ari.org	
ASCA	Architectural Spray Coaters Association www.ascassoc.com	(609) 848-6120
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	American Society for Testing and Materials www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industries International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (See WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(817) 326-6300
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312

CCFSS	Center for Cold-Formed Steel Structures www.umn.edu/~ccfss	(573) 341-4471
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CCFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 412-0900
CGSB	Canadian General Standards Board www.pwgsc.gc.ca/cgsb	(819) 956-0425
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association (Formerly: National Particleboard Association) www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)	(281) 583-4087

	www.cti.org	
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA/TIA	Electronic Industries Alliance/Telecommunications Industry Association www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eifsfacts.com	(800) 294-3462 (770) 968-7945
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FCI	Fluid Controls Institute www.fluidcontrolsinstitute.org	(216) 241-7333
FGMA	Flat Glass Marketing Association (See GANA)	
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmgglobal.com	(401) 275-3000
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association) www.glasswebsite.com/gana	(785) 271-0208
GRI	Geosynthetic Research Institute www.drexel.edu/gri	(215) 895-2343
GTA	Glass Tempering Division of Glass Association of North America (See GANA)	
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc.	(410) 838-6550

	www.hpwhite.com	
IAS	International Approval Services (See CSA International)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(508) 394-4424
ICRI	International Concrete Repair Institute (The) www.icri.org	(703) 450-0116
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
IRI	Industrial Risk Insurers www.industrialrisk.com	(800) 243-78308 (860) 520-7300
ITS	Intertek Testing Services www.itsglobal.com	(800) 345-3851 (607) 753-6711
IWS	Insect Screening Weavers Association (Now defunct)	
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LGSI	Light Gage Structural Institute www.loseke.com	(972) 370-0967
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association) www.lma.org	(201) 664-2700
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
LSGA	Laminated Safety Glass Association (See GANA)	
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(312) 201-0193

MFMA	Maple Flooring Manufacturers Association www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association	(312) 644-6610
MGPHO	Medical Gas Professional Healthcare Organization, Inc. www.mgpho.org	(877) 238-5157 (913) 681-6548
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(614) 228-6194
ML/SFA	Metal Lath/Steel Framing Association (See SSMA)	
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NAAMM	North American Association of Mirror Manufacturers (See GANA)	
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NAIMA	North American Insulation Manufacturers Association (The) www.naima.org	(703) 684-0084
NAMI	National Accreditation and Management Institute, Inc.	(304) 258-5100
NAPM	National Association of Photographic Manufacturers (See PIMA)	
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(414) 248-9094
NCTA	National Cable Television Association www.ncta.com	(202) 775-3669
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698

NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFPA	National Fire Protection Association www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-6372
NGA	National Glass Association www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NPA	National Particleboard Association (See CPA)	
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSA	National Stone Association www.aggregates.org	(800) 342-1415 (703) 525-8788
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NTMA	National Terrazzo and Mosaic Association, Inc. www.ntma.com	(800) 323-9736 (703) 779-1022
NWWDA	National Wood Window and Door Association (See WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300

PDCA	Painting and Decorating Contractors of America www.pdca.com	(800) 332-7322 (703) 359-0826
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (508) 230-3516
PGI	PVC Geomembrane Institute //pgi-tp.ce.uiuc.edu	(217) 333-3929
PIMA	Photographic & Imaging Manufacturers Association (Formerly: NAPM - National Association of Photographic Manufacturers) www.pima.net	(914) 698-7603
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400
RFCI	Resilient Floor Covering Institute (Contact by mail only)	
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
RMA	Rubber Manufacturers Association www.rma.org	(800) 220-7620 (202) 682-4800
SAE	SAE International www.sae.org	(724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabfurn.com	(843) 689-6878
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIGMA	Sealed Insulating Glass Manufacturers Association www.sigmaonline.org/sigma	(312) 644-6610
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.;	(800) 523-6154

	Spray Polyurethane Foam Division) www.sprayfoam.org	
SPI	The Society of the Plastics Industry www.plasticsindustry.org	(202) 974-5200
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPI/SPFD	The Society of the Plastics Industry Spray Polyurethane Foam Division (See SPFA)	
SPRI	SPRI (Single Ply Roofing Institute) www.spri.org	(781) 444-0242
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association) www.ssma.com	(312) 456-5590
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(800) 837-8303 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, and Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TPI	Truss Plate Institute	(608) 833-5900
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 705-9898
UFAC	Upholstered Furniture Action Council www.ufac.org	(336) 885-5065
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800

UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USITT	United States Institute for Theatre Technology, Inc. www.culturenet.ca/usitt	(800) 938-7488 (315) 463-6463
USP	U.S. Pharmacopeia www.usp.org	(800) 822-8772 (301) 881-0666
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (Formerly: AWCMA - American Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4653 (212) 661-4261
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WIC	Woodwork Institute of California www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc. www.bocai.org	(708) 799-2300
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials (The) www.iapmo.org	(909) 595-8449
ICBO	International Conference of Building Officials www.icbo.org	(800) 284-4406 (562) 699-0541
ICC	International Code Council	(703) 931-4533

(Formerly: CABO - Council of American Building
Officials)
www.intlcode.org

SBCCI Southern Building Code Congress International, Inc. (205) 591-1853
www.sbcci.org

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-0990
DOC	Department of Commerce www.doc.gov	(202) 482-2000
EPA	Environmental Protection Agency www.epa.gov	(202) 260-2090
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
FCC	Federal Communications Commission www.fcc.gov	(202) 418-0190
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(202) 708-5082
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley Laboratory (See LBNL)	
LBNL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-5605
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(202) 693-1999
RUS	Rural Utilities Service	(202) 720-9540

(See USDA)

TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CAPUC (See CPUC)

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 445-1254
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Products Laboratory //txforestservicetamu.edu	(936) 639-8180

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

1.3 TEMPORARY AND PERMANENT FACILITIES

- A. General: Use charges are the cost or use charges for temporary facilities which are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
 - 1. Owner's 3rd party construction forces.
 - 2. Occupants of Project / Contractor and contractor forces.
 - 3. Architect.
 - 4. Testing agencies.
- B. Water Service: The General Contractor shall have access to existing exterior hose bibbs for their use in cleanup. All existing areas surrounding any hose bibbs are to be left free of any deviations. Replacement of landscaping and any cleaning required as a result of contractor use of exterior bibbs shall be at the contractor's cost.
- C. Electric Power Service is currently accessible within the building. Contractor shall have access to permanent power outlets available. Ensure all equipment connected to the permanent power supply is within the rating requirements for each circuit and does not overload the system.
- D. Sewer: The General contractor shall make arrangements for temporary sanitation facilities for the entire construction period. The permanent toilet facilities may only be used under special requirements and approval of the owner.

1.4 PROJECT CONDITION

- A. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - 1. Keep temporary services and facilities clean and neat.
 - 2. Relocate temporary services and facilities as required by progress of the Work.
 - 3. Coordinate all work with owner's field representative prior to taking action.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Existing elevators may be used by Contractors. Protect all elevator finishes with blankets and other materials as required. Obey the weight limit capacity for each cab as indicated by the cab nameplate.
- B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply. Existing drinking fountains on-site are not to be used by Contractors.
- G. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
 - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.
- I. Provide a min. of five (5) hard hats and goggles to be made available to the Architect and visitors on the site during the construction period.

END OF SECTION 01500

SECTION 01600 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative requirements for handling requests for substitutions made prior to and after award of the Contract.
- B. The Contractor's Construction Schedule is included under the conditions of the Contract.
- C. Standards: Refer to Section "References" for applicability of documented industry standards to products specified.
- D. Procedural needs governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor are considered requests for "substitutions." The following are not considered substitutions:
 - 1. Revisions to Contract Documents requested by the Owner or Architect.
 - 2. Specified options of products and construction methods included in Contract Documents.

1.4 PRE-BID SUBSTITUTIONS

- A. The intent of the documents is to provide for competitive bidding. The naming of specified items on the drawings or in the specifications means that such named items are specifically desired by the Architect and/or Owner and establishes a standard of quality declared for design and appearance performance. The facility has been designed according to the details and performance characteristics of the item specified. The words "or acceptable equal" or "or approved equal" follows such named items, substitution requests may be submitted. The burden of proof of equal is the responsibility of the entity requesting the substitution. **REQUESTS FOR SUBSTITUTION MUST BE RECEIVED BY ARCHITECT 10 BUSINESS DAYS PRIOR TO BID OPENING.**
- B. **Substitution Request Forms:** Requests must be submitted on copies of the attached form and must name the exact item proposed with complete information filled out and back-up data attached as specified on that form. It shall identify appearance deviation, and performance variations and other differences between that specified and that proposed. Use separate Substitution Request Form for each item. Submit two copies of form and back-up data for architectural items and three copies of form and back-up data for mechanical and electrical items. Requests showing only brand name or manufacturer, or otherwise incomplete, will not be reviewed. Submit samples if requested.
- C. The Architect is the sole judge as to the equality of proposed substitutions. **ONLY WRITTEN ACCEPTANCES WILL BE HELD VALID BY THE ARCHITECT.**
- D. If any substitution will affect a correlated function, adjacent construction, or the work of other trades or contractors, the necessary changes and modifications to the affected work will be considered as part of the substitution, to be accomplished without additional cost to the Owner, if and when accepted.

If, after acceptance of the "equal" product, the substitution is found to be at variance with the specified item, or lacking in performance claimed; the contractor may be required to remediate the condition to the satisfaction of the owner, at no additional cost to the owner.

- E. The Architect will review substitution requests within reasonable time. The Architect is not obligated or required to review any and all substitution requests. The Architect is not obligated to inform bidders of incomplete and non-accepted requests. Acceptance of substitutions will be indicated in writing by addendum.
- F. Under no circumstances shall be Architect's acceptance of any such substitution relieve the Contractor from timely, full and proper performance of the work.

1.5 SUBMITTALS after Bid:

- A. Substitution Request Submittal: Requests for Substitutions are discouraged after bidding. The owner has the right to receive the product and quality level specified and bid. However, Requests for Substitution may be considered if received within 30 days after commencement of the Work. Grounds for substitution may include issues of quality upgrade, specified product no longer in production. Requests received may be considered or rejected at the discretion of the Architect.
 - 1. Submit 1 copy of each request for substitution for consideration on the form provided. Submit requests in the form and in accordance with procedures required for Change Orders.
 - 2. Identify the product, or the fabrication or installation method to be replaced in each request. **Include related Specification and Drawing numbers.** Provide complete documentation showing compliance with the requirements for substitutions, and the following information:
 - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - e. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
 - 3. Architect's Action: Within one week of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of an Addendum or e-mailed approval after the project is started.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
 - 1. Extensive revisions to Contract Documents are not required.
 - 2. a. All costs, including re-design and engineering, unjustified evaluation expense, and ancillary field adaptation is included in the cost.

- 2.b. Proposed changes are in keeping with the intent of Contract Documents.
 3. The request is timely, fully documented and properly submitted.
 4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
 5. Deleted
 6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner include Additional Services compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
 7. 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.
 8. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- B. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid Request for Substitution, nor does it constitute approval by the Architect.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01600

Section 01601 SUBSTITUTION REQUEST FORM

PROJECT: PN 15088 OTC Richwood Valley Campus FEMA Shelter Infill

E-MAIL TO:

Attn: Ryan Faust @ rf@batesarchitects.com

SPECIFIED ITEM: _____
Section Reference _____

PROPOSED SUBSTITUTE: _____

SUBMITTED BY:

Firm: _____

Address: _____

Signature: _____

Date: _____ Phone No. _____

Attach complete description, designation, catalog or model number, Spec Data Sheet and other Technical Data, including Laboratory Tests if Applicable.

FILL IN BLANKS BELOW:

1. Will substitution affect dimension indicated on drawings?

2. Will substitution affect wiring, piping, ductwork, etc., indicated on drawings?

3. What effect will substitution have on other trades?

4. Differences between proposed substitution and specified item?

5. Any and all impacts on costs, design modifications, additional architectural and engineering services, material and labor changes, schedule changes, and other unanticipated consequences, resulting from this substitution in lieu of the specified item, shall be the full responsibility of the contractor and his subcontractors and supplier.

6. Manufacturer's warranties of the specified items and proposed items are: same different, explain:

REVIEW COMMENTS:

- No Exception taken to Submitted Manufacturer
- No Exception taken to Specific Products
- Exceptions Noted (See attached copy or notes on product literature)
- Not Accepted
- Received too Late

By: _____ Date: _____

Remarks: _____

SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes but is not limited to general procedural requirements governing execution of the Work including, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.
9. Final Cleaning

- B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Submittal Procedures" for submitting surveys.
3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: 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.
1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: 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 affecting the Work.
1. 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.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. 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. Written Report: As a part of the pre construction conference- submit a written report listing conditions detrimental to performance of the Work required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to the Owner 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.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two business days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.
- C. Field Measurements: 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.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

3.3 CONSTRUCTION LAYOUT

- A. Verification: 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.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. 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.
 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the Work progresses.
 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: 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.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner has identified on the survey provided, existing benchmarks, control points, and property corners.

- B. Reference Points: The Contractor shall 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 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. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 4. Maintain minimum headroom clearance of **8 feet** in spaces without a suspended ceiling.
- E. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- F. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- G. 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.
- H. Tools and Equipment: For tools or equipment that potentially produce harmful noise levels; coordinate operation with owner's rep. to minimize disruption to classes.
- I. 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.
- J. 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.
- K. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site and facility for Owner's construction forces. The owner's construction forces include but are not limited to:

Work related to Data wiring, end point data connections, work in the Main Distribution Facility, cable trays, and electrical room. Work related to installation of instructional equipment such as multi-media projectors and screens in classrooms and labs.

Work related to purchasing and placing Laboratory Equipment.

Work related to purchasing, delivery, temporary storage, and installation instructional equipment, FF&E, including but not limited to desks, chairs, and instructional equipment.

- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces. It is the contractor's responsibility to coordinate all work including the work of the owner or owner's separate contractors. Coordination mean consulting with parties to ascertain when their activities need to fit the schedule to satisfy party and construction needs. To verify all parties have ordered materials and equipment needed to achieve their schedule timely. To assure all parties arrive and remain in place while scheduled work occurs. To cooperate with owners separate contractors as they work to get back on schedule should they get behind. To assist all parties in receiving and temporarily storing materials. To monitor the condition of work in place to determine if construction related damage has occurred by forces other than the contractor.

Communicate 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.

1. Pre-installation Conferences: Include Owner's construction forces at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.
2. FF&E trash removal. The Contractor shall provide trash removal facilities at the site to remove packaging, crating, and refuse that results from the shipment and installation of Owners contractors.
3. Provide in wall and exposed blocking and furring for supporting the installation of owner furnished equipment and Furnishings as required for a complete installation.
4. Hook up and integration of installation with Contractor work. The Contractor shall provide electricians, carpenters, and labor as required to hook up the lab. equipment and owners FF&E items. The cost of this work is provided for in a separate Allownace entitled Hook ups.
5. Temporary storage in the new facility. As the project is completed the owners separate contractors may require temporary on site storage for staging and installation. The Contractor shall work with the owners representative to provide finished portions of the facility that will allow storage, uncrating, and placement of the equipment and furnishings.

3.6 PROGRESS CLEANING

- A. General: Clean Project 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.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. 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 (27 deg C).
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. 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.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. 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.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.7 STARTING AND ADJUSTING
- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest. **Insure all liquid lines are free of residue and debris before charging and testing. Clean all filters after testing.**

- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. 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 in Division 1 Section "Quality Requirements."

3.8 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.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

SECTION 01770 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Operating and maintenance manual submittal.
 - 4. Submittal of Release of Liens and warranties.
 - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. The Contractor shall list items that are incomplete in the request (Initial Punch List).
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a **list of incomplete items**, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise Owner of pending insurance and utility change-over requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents including **Final Lien Waivers**.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement, and similar final record information.
 - 6. Deliver tools, spare parts, extra stock, and similar items. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Submit test/adjust/balance records. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
 - 9. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. **Observation Procedures:** On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
 - 1. Upon written statement from the Contractor that the Work is complete, the Architect will repeat the inspection and notification procedure. **In the event the work is not complete, the Architect will repeat the inspection process but, Additional inspections are at the expense of the Contractor. The Architect will conduct one Final Inspection. Further inspection procedures**

will be at the expense of the Contractor.

2. Results of the completed inspection will form the basis of requirements for final acceptance.
3. Release of Retainage or portions there of will not be approved without Consent of Surety.
4. Release of retainage or portions thereof will be determined by a multiplier of three (3) applied to all remaining work not complete. Inspections to determine status of work complete and , therefore, release of retainage and pay applications are contingent upon the limits to number of inspections indicated above in 1.3.B.1.
5. Also see Supplementary General Conditions requirements.

1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request. (See Supplementary General Conditions also.)
 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
 4. Submit pest-control final inspection report and warranty.
 4. **Submit consent of surety to final payment.**
 5. Submit a final liquidated damages settlement statement.
 6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 7. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
 7. Submit Final Lien waivers.
- B. **INSPECTION SUMMARY**
 1. **Architect will conduct one (1) inspection at notification for Substantial Completion.**
 2. **Architect will conduct only one (1) inspection, for determining Substantial Completion.**
 3. **Architect will conduct one (1) inspection for Final Completion.**
 5. **Any additional inspections for Substantial Completion, partial completion inspections, or Final Completion will be at the cost of the Contractor.**

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Contractor: Submit list digitally using A360. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.6 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss

in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 - 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 - 3. Note related Change Order numbers where applicable.
 - 4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.
 - 1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
 - 1. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.
- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.
- G. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
 - 1. Emergency instructions.
 - 2. Spare parts list.
 - 3. Copies of warranties.
 - 4. Wiring diagrams.
 - 5. Recommended "turn around" cycles.
 - 6. Inspection procedures.
 - 7. Shop Drawings and Product Data.
 - 8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
1. Maintenance manuals.
 2. Record documents.
 3. Spare parts and materials.
 4. Tools.
 5. Lubricants.
 6. Fuels.
 7. Identification systems.
 8. Control sequences.
 9. Hazards.
 10. Cleaning.
 11. Warranties and bonds.
 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Start-up.
 2. Shutdown.
 3. Emergency operations.
 4. Noise and vibration adjustments.
 5. Safety procedures.
 6. Economy and efficiency adjustments.
 7. Effective energy utilization.

3.2 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for

cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01770

SECTION 054000 - COLD-FORMED METAL FRAMING

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. This Section includes the following:
1. Interior load-bearing wall framing.
 2. Exterior non-load-bearing wall framing.
- B. Related Sections include the following:
1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..
 - b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
 - c. Floor Joist Framing: Vertical deflection of 1/480 for live loads and 1/360 for total loads of the span.
 - d. Roof Rafter Framing: Horizontal deflection of 1/360 of the horizontally projected span.
 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows: a. Upward and downward movement of 1 inch.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
 3. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation. C. Welding certificates.
- D. Qualification Data: For professional engineer.

- E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- F. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 - 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering coldformed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied Studco.
 - 2. AllSteel Products, Inc.
 - 3. California Expanded Metal Products Company.

4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: ST50H.
 2. Coating: G60.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: 50, Class 1 or 2.
 2. Coating: G90.

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0329 inch.
 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Flange Width: 1-1/4 inches unless noted otherwise.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: 1-5/8 inches.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0329 inch.
 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: Matching steel studs, unless noted otherwise.
 2. Flange Width: 1-1/4 inches, unless noted otherwise.
- C. Vertical Deflection Clips: as indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: 2 ½”.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: 2 ½”.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: 1 ¼”.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers, knee braces, and girts.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere. F.
- Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: [SSPC-Paint 20 or DOD-P-21035] [ASTM A 780].
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and waterreducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: To match stud spacing.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 - 1. Stud Spacing: 16 inches.

- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced 48 inches. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and studtrack solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
 - 4. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat

- straps to stud flanges and secure solid blocking to stud webs or flanges. a. Install solid blocking at 96-inch centers.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and studtrack solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: 16 inches.
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joisttrack solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

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. Steel framing and supports for overhead doors and grilles.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Shelf angles.
6. Metal floor plate and supports.
7. Metal bollards.
8. Metal downspout boots.
9. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Division 05 Section "Structural Steel Framing."
4. Division 05 Section "Pipe and Tube Railings".

1.3 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Prefabricated building columns.
2. Paint products.
3. Grout.

- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Qualification Data: For qualified professional engineer.
- D. Welding certificates.
- E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- C. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

- D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B structural steel, Grade 33; 0.0677-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- G. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Eyebolts: ASTM A 489.
- G. Machine Screws: ASME B18.6.3.
- H. Lag Screws: ASME B18.2.1.
- I. Wood Screws: Flat head, ASME B18.6.1.
- J. Plain Washers: Round, ASME B18.22.1.
- K. Lock Washers: Helical, spring type, ASME B18.21.1.
- L. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

- M. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- N. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless steel bolts, ASTM F 593, and nuts, ASTM F 594.
- O. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections and Division 09 Section "High-Performance Coatings."
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.
- E. Galvanize miscellaneous framing and supports where indicated.
- F. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer. Paint all exposed steel.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with zinc-rich primer

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Prime bollards with zinc-rich primer

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.
- C. Prime plates with zinc-rich primer

2.11 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.

- C. Galvanize loose steel lintels located in exterior walls. **Paint all exposed steel lintels**, whether specifically noted on the drawings or not.

2.12 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items[not indicated to be galvanized] unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with [universal shop primer] [primers specified in Division 09 painting Sections] unless [zinc-rich primer is] [primers specified in Division 09 Section "High-Performance Coatings" are] indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with [SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."] [SSPC-SP 3, "Power Tool Cleaning."] [requirements indicated below:]
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.4 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

A. RELATED DOCUMENTS

- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Wood blocking, cants and nailers.
2. Wood furring and grounds.
3. Plywood backing panels.
4. Metal column base.

- B. Related Sections include the following:

1. Division 6: Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

- B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

2.2 FIRE RETARDANT/TREATED WOOD

- A. Fire Retardant/Preservative pressure treat lumber and plywood with water-borne preservatives to comply with AWPB LP-22 and C9, respectively, and with requirements indicated below:
 - 1. Wood for Ground Contact Use: AWPB LP-22.
 - 2. Wood for Above-Ground Use: AWPB LP-2.
 - 3. Treat cants, nailers, blocking, stripping and similar items in conjunction with roofing, flashing, vapor barriers, and water proofing.
 - 4. Treat sills, sleepers, blocking, furring, stripping and similar items in direct contact with masonry or concrete.
 - 5. All lumber shall be kiln dried after treatment (KDAT).
- B. Unless approved otherwise, wood indicated for fire-retardant treatment shall comply with AWPB C20 (lumber) and AWPB C27 (plywood) for treatment type indicated below. Provide label of UL or other testing and inspection agency acceptable to authorities having jurisdiction on each piece treated.
 - 1. Interior Type A: Use where "FRTW" wood is indicated on interior.
 - 2. Exterior Type: Use where "FRTW" is indicated for exterior, exposed applications.

2.3 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
- B. 5/8" CDX A.P.A. fire retardant plywood backing, for Metal Wall Panel System specified in Section 07415.
- C. Moisture Protection: (Refer also to section 07275)
 - 1. Vaproshield – WallShield Manufacturer: A. Proctor Group
 - 2. Material: Triple layer, spun bonded polypropylene, breathable membrane:
 - 3. Characteristics: Nominal weight 0.521 oz./sq ft
Nominal Thickness: 0.0024"
Water Vapor Transmission: 21 perms per ASTM E96-95.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in the 2012 IBC international Building Code.
- D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- E. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

- F. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- G. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

3.2 WOOD FRAMING INSTALLATION, GENERAL

- A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Do not splice structural members between supports.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
 - 1. Fire block furred spaces of walls, at each floor level and at ceiling, with wood blocking or noncombustible materials accurately fitted to close furred spaces.

END OF SECTION 06100

SECTION 06200 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following
 1. Interior standing and running trim for field-painted finish.
 2. Shelving and clothes rods.
 3. Aluminum Wall Edge and Corner Guards
- B. Related Sections include the following:
 1. Division 6 Section "Miscellaneous Carpentry" for furring, blocking, and other carpentry work not exposed to view.
 2. Division 6 Section "Interior Architectural Woodwork" for interior woodwork not specified in this Section.
 3. Division 9 Section "Painting" for priming and backpriming of finish carpentry.

1.3 DEFINITIONS

- A. Inspection agencies, and the abbreviations used to reference them, include the following:
 1. NELMA - Northeastern Lumber Manufacturers Association.
 2. NHLA - National Hardwood Lumber Association.
 3. NLGA - National Lumber Grades Authority.
 4. RIS - Redwood Inspection Service.
 5. SCMA - Southern Cypress Manufacturers Association.
 6. SPIB - Southern Pine Inspection Bureau.
 7. WCLIB - West Coast Lumber Inspection Bureau.
 8. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.
 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

- B. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer.
- B. Fire-Test-Response Characteristics: Where fire-retardant materials are indicated, provide materials with specified fire-test-response characteristics as determined by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency on surfaces of materials that will be concealed from view after installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
- B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Primed Hardboard Trim:
 - a. ABT Co.; a Louisiana-Pacific Company.

- b. Georgia-Pacific Corp.
- c. Temple-Inland Forest Products Corp.

2.2 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece.
- B. Softwood Plywood: DOC PS 1.
- C. Hardwood Plywood: HPVA HP-1.
- D. Hardboard: AHA A135.4
- E. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
- F. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
 - a. Alkaline copper quaternary (ACQ).
 - b. Copper bis (dimethyldithiocarbamate) (CDDC).
 - c. Ammoniacal copper citrate (CC).
 - d. Copper azole, Type A (CBA-A).
 - e. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
 - 2. Do not use chemical formulations that require incising.
 - 3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
 - 4. Kiln-dry material after treatment to levels required for untreated material. Do not use material that is warped or does not comply with requirements for untreated material.
 - 5. Mark each treated item with the Quality Mark Requirements of an inspection agency approved by the American Lumber Standards' Committee Board of Review.

2.4 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated lumber and plywood are indicated, use materials impregnated with fire-retardant chemicals by a pressure process or other means acceptable to authorities having jurisdiction to produce products with the following fire-test-response characteristics:

1. Flame-spread index of not greater than 25 when tested according to ASTM E 84.
 2. Flame-spread index of not greater than 25 when tested according to ASTM E 84 with test continued for a period of 30 minutes with no evidence of significant progressive combustion. Flame front shall not progress more than 10-1/2 feet beyond centerline of burner at any time during test.
- B. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
- C. Interior, Low-Hygroscopic-Type, Fire-Retardant Treatment: Formulation that results in treated material with an apparent moisture content of not more than 28 percent when tested according to ASTM D 3201 at 92 percent relative humidity.
- D. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber and plywood from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- E. Kiln-dry material after treatment to levels required for untreated material. Do not use material that does not comply with requirements for untreated material or is warped or discolored.
- 2.5 Deleted.
- 2.6 Deleted.
- 2.7 Aluminum Wall and Edge Trim: (Corner Guards) Provide 2" x 2" x 1/8" corner guards of aluminum angles with finish to match aluminum curtainwall. Lengths to be floor to ceiling or as approved by the architect. Anchor with adhesive and or aluminum screws finished to match the guards. See Series A800 sheets for locations.
- 2.8 MISCELLANEOUS MATERIALS
- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws of the following materials, in sufficient length to penetrate minimum of 1-1/2 inches into substrate, unless otherwise recommended by manufacturer:
1. Stainless steel.
 2. Hot-dip galvanized steel.
 3. Aluminum.
 4. Prefinished aluminum in color to match stain, where face fastening of material to receive stain is unavoidable.
- B. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.
- C. Paneling Adhesives: Comply with paneling manufacturer's written recommendations for adhesives.

- D. Glue: Aliphatic- or phenolic-resin wood glue recommended by manufacturer for general carpentry use.
- E. Sealants: Comply with requirements in Division 7 Section "Joint Sealants" for materials required for sealing siding work.

2.9 FABRICATION

- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.
- B. Back out or kerf backs of the following members, except members with ends exposed in finished work:
 - 1. Interior standing and running trim, except shoe and crown molds.
- C. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer].
- C. Prime lumber for exterior applications to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 9 Section "Painting."

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 4. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.
 5. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
1. Match color and grain pattern across joints.
 2. Install trim after gypsum board joint finishing operations are completed.
 3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
 4. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

3.5 ADJUSTING

- A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 06200

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Plastic-laminate cabinets.
 - 2. Plastic-laminate countertops.
 - 3. Shop finishing interior woodwork.
 - 4. Millwork
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 - 2. Division 6 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.
 - 3. Division 9 Section "Painting" for field finishing of interior architectural woodwork.

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.
- B. Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stairwork are specified in Division 6 Section "Rough Carpentry."

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories, and finishing materials and processes.
- B. Product Data: For hardboard, medium-density fiberboard, plywood, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, fire-retardant-treated materials, cabinet hardware and accessories, and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
 3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 4. Apply WIC-certified compliance label to first page of Shop Drawings.
 5. Show location of blocking required for anchorage of cabinetwork to structure. Coordinate with Contractor.
- D. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
1. Shop-applied opaque finishes.
 2. Plastic laminates.
 3. Hardware for cabinets
- E. Samples for Verification: For the following
1. Wood-veneer-faced panel products with or for transparent finish, 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.
 2. Lumber and panel products with shop-applied opaque finish, 50 sq. in. for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.
 3. Plastic-laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
 4. Corner pieces as follows:
 - a. Cabinet front frame joints between stiles and rail, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 5. Exposed cabinet hardware and accessories, one unit for each type and finish.
- F. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.
- G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has

resulted in construction with a record of successful in-service performance for a minimum of five years.

- B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork with sequence-matched wood veneers including wood doors where veneer matching includes door faces.
- D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
- E. Quality Standard: Unless otherwise indicated, comply with WIC's "Manual of Millwork" for grades of interior architectural woodwork, construction, finishes, and other requirements.
- F. Mockups: Before fabricating and installing interior architectural woodwork, build mockup for a representative sample of millwork quality and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be fabricated and installed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's approval of mockups before starting interior architectural woodwork fabrication.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Demolish and remove mockups when directed.
 - 7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- G. Pre-installation Conference: Conduct conference at Project site prior to fabricating cabinets for final millwork review.
- H. Provide manufacturer's warranty for all materials and labor against defects and workmanship for a period of not less than three years.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork 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.
- B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and will maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.
- C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 8 Section "Door Hardware" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

- A. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by an Owner-approved fabricator.
- B. Cabinets shall be as manufactured by Instructors Mfg. Co., Inc. Equal products of Alpine Wood Products, Billings & Associates, Carroll Seating Company (TMI), Cabinets by RKC, Creative Associates, K.S. Wood Products, S&W Cabinets, Hicks-Ashby, or approved equal.

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. General: Provide materials that comply with requirements of the WIC quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

- C. Wood Species for Opaque Finish: Poplar.
- D. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
 - 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 - 4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - 5. Hardwood Plywood and Face Veneers: HPVA HP-1.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
 - a. Formica Corporation.
 - b. Nevamar.
 - c. Laminart.
 - d. Pionite.
 - e. Westinghouse Electric Corp.; Specialty Products Div.
 - f. Wilsonart International; Div. of Premark International, Inc.
- F. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to authorities having jurisdiction to produce products with fire-test-response characteristics specified.
 - 1. Do not use treated material that does not comply with requirements of referenced woodworking standard or that is warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with AWPA C20 (lumber) and AWPA C27 (plywood), for woodwork items indicated as fire-retardant treated. Use the following treatment type:
 - 1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln-drying.
 - 2. Interior Type A: Low-hygroscopic formulation.
 - 3. Mill lumber after treatment, within limits set for wood removal that does not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
 - 4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 - 5. Kiln-dry material before and after treatment to levels required for untreated material.
- C. Fire-Retardant-Treated Lumber and Plywood by Nonpressure Process: Apply nontoxic, water-soluble, fire-retardant treatment by dip, spray, roller, curtain coating, vacuum chamber, or

soaking to achieve flame-spread rating of [25] [75] or less and smoke-developed rating of 450 or less per ASTM E 84.

- D. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread rating of 25 or less and smoke-developed rating of 25 or less per ASTM E 84.
1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: density, 45-lb/cu. ft; modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 lbf and 225 lbf, respectively.
 2. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: density, 44-lb/cu. ft; modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 lbf and 175 lbf, respectively.
 3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Willamette Industries, Inc.
- E. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread rating of 25 or less and smoke-developed rating of 200 or less per ASTM E 84.
1. Product: Subject to compliance with requirements, provide "Medite FR" by SierraPine Ltd; Medite Div.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch- thick metal, and as follows:
1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
 2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- D. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- E. Wire Pulls: Back mounted, 4 inches long, 5/16 inches in diameter.
- F. Catches: Roller catches BHMA A156.9, B03071.
- G. Adjustable Shelf Standards and Supports.
- H. Shelf Rests: BHMA A156.9, B04013.
- I. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:

1. Box Drawer Slides: 100 lbf.
- J. Door Locks: BHMA A156.11, E07121.
- K. Drawer Locks: BHMA A156.11, E07041.
- L. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 1. Product: Subject to compliance with requirements, provide "SG series" by Doug Mockett and Co., Inc.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated. Finish shall be brushed aluminum.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.6 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Premium grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
 3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
1. Seal edges of openings in countertops with a coat of varnish.
- 2.7 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH
- A. Quality Standard: Comply with AWI Section 300.
 - B. Grade: Custom.
 - C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
 - D. Assemble casings in plant except where limitations of access to place of installation require field assembly.
 - E. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.
 - F. Wood Species: Poplar; 15% moisture.
- 2.8 PLASTIC-LAMINATE CABINETS
- A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.
 - B. Quality Standard: Comply with WIC Section 15.
 - C. Grade: Custom.
 - D. AWI Type of Cabinet Construction: Flush overlay.
 - E. WIC Construction Style: Style B, Face Frame.
 - F. WIC Construction Type: Type II, single-length sections to fit access openings.
 - G. WIC Door and Drawer Front Style: Flush overlay.
 - H. Reveal Dimension: 1/2 inch.
 - I. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: HGS, HGL.
2. Vertical Surfaces: VGS.
3. Edges: VGS.

J. Materials for Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative overlay (Melamine).
2. Drawer Sides and Backs: Thermoset decorative overlay.
3. Drawer Bottoms: Thermoset decorative overlay.

K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Architect to select from laminate manufacturer's full range of colors and finishes in the following categories:
 - a. Solid colors.
 - b. Solid colors with core same color as surface.

L. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.9 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.
- B. Quality Standard: Comply with WIC Section 16.
- C. Grade: Custom.
- D. High-Pressure Decorative Laminate Grade: HGS, HGP.
- E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. Architect to select from manufacturer's full range of colors and finishes in the following categories:
 - a. Solid colors.
- F. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- G. Core Material: Particleboard or medium-density fiberboard.
- H. Core Material at Sinks: medium-density fiberboard made with exterior glue,.
- I. Quality Standard: Comply with AWI Section 900.

2.10 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

- A. Quality Standard: Comply with AWI Section 900.
- B. Quality Standard: Comply with WIC Section 12.

- C. Grade: Custom.
- D. Wood Species: Poplar.

2.11 SHOP FINISHING

- A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
- B. Quality Standard: Comply with WIC Section 25, unless otherwise indicated.
 - 1. Grade: Provide finishes of same grades as items to be finished.
- C. General: Priming and finishing of interior architectural woodwork required to be performed at fabrication shop are specified in this Section. Refer to Division 9 Section "Painting" for final finishing of installed architectural woodwork and for material and application requirements for woodwork not specified to receive final finish in this Section.
- D. General: Shop finish transparent finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 9 Section "Painting" for finishing opaque finished architectural woodwork.
- E. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.
- F. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.
 - 1. Grade: Custom.
 - 2. AWI Finish System OP-6: Catalyzed polyurethane.
 - 3. Color: As selected by Architect from the full range of colors available in finish system specified.
 - 4. Sheen: Satin, 30-50 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Quality Standard: Install woodwork to comply with WIC Section 26 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c.
 - 4. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
- I. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.
- J. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402

SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Concealed building insulation.
- B. Related Sections include the following:
 - 1. Division 9 Section "Gypsum Board Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.
 - 2. Division 15 Sections "Duct Insulation" and "Pipe Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Glass-Fiber Insulation:
 - a. CertainTeed Corporation.
 - b. Johns Manville Corporation.
 - c. Knauf Fiber Glass.
 - d. Owens Corning.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
 - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Un-faced, Flexible Glass-Fiber Board Insulation: ASTM C 612, Type IA; ASTM C 553, Types I, II, and III; or ASTM C 665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
 - 1. Nominal density of 1.0 lb/cu. ft., thermal resistivity of 3.7 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 2. Nominal density of not less than 1.5 lb/cu. ft. nor more than 1.7 lb/cu. ft., thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 3. Combustion Characteristics: Passes ASTM E 136.

2.3 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- B. Mechanical Anchors: As recommended by insulation manufacturer for type of application and condition of substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

- A. On vertical surfaces, set units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer. Install 1 ½" thick rigid insulation boards vertically with the long dimension in the horizontal direction against interior face of perimeter foundation walls.

3.6 INSTALLATION OF BATT INSULATION

- B. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- C. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

- D. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
- E. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.
1. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
 2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.
- F. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

END OF SECTION 07210

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:

- B. This Section includes sealants for the following applications:

- 1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:

- a. Control and expansion joints in unit masonry.
- b. Joints in exterior insulation and finish systems.
- c. Joints between metal panels.
- d. Perimeter joints between materials listed above and frames of doors and windows.
- e. Other joints as indicated.

- 2. Exterior joints in the following horizontal traffic surfaces:

- a. Control, expansion, and isolation joints in cast-in-place concrete slabs
- b. Other joints as indicated.

- 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

- a. Control and expansion joints on exposed interior surfaces of exterior walls.
- b. Perimeter joints of exterior openings where indicated.
- c. Tile control and expansion joints.
- d. Vertical control joints on exposed surfaces of interior unit masonry and partitions.
- e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
- f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
- g. Other joints as indicated.

- 4. Interior joints in the following horizontal traffic surfaces:

- a. Control and expansion joints in cast-in-place concrete slabs.
- b. Control and expansion joints in tile flooring.
- c. Other joints as indicated.

- C. Related Sections include the following:

- 1. Division 4 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
- 2. Division 7 Section "Firestopping" for fire-resistant building joint-sealant systems.
- 3. Division 8 Section "Glazing" for glazing sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates as follows:
 - 1. Locate test joints where indicated or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - 3. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
 - 4. Test Method: Test joint sealants by hand-pull method described below:
 - a. Install joint sealants in 60-inch-long joints using same materials and methods for joint preparation and joint-sealant installation required for the completed Work. Allow sealants to cure fully before testing.
 - b. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
 - c. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
 - d. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.
 - 5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of

product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- C. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.
- D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Continuous-Immersion-Test-Response Characteristics: Where elastomeric sealants will be immersed continuously in water, provide products that have undergone testing according to ASTM C 1247, including initial six-week immersion period and additional immersion periods specified below, and have not failed in adhesion or cohesion when tested with substrates indicated for Project.
1. One additional four-week immersion period.

- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.4 SOLVENT-RELEASE JOINT SEALANTS

- A. Acrylic-Based Solvent-Release Joint-Sealant Standard: Comply with FS TT-S-00230 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.
- B. Butyl- Rubber-Based Solvent-Release Joint-Sealant Standard: Comply with ASTM C 1085 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.

2.5 LATEX JOINT SEALANTS

- A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.6 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.

2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

- D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Medium-Modulus Neutral-Curing Silicone Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
 - 1. Products: Available products include the following.
 - a. 791; Dow Corning.

- b. 795; Dow Corning.
 - c. SM5731 Poly-Glaze; Schnee-Morehead, Inc.
 - d. SM5733 Poly-Glaze; Schnee-Morehead, Inc.
 - e. Spectrem 2; Tremco.
 - f. Trensil 600; Tremco.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick, granite, limestone, marble, ceramic tile, and wood.
 6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
- B. Mildew-Resistant Silicone Sealant: Where joint sealants of this type are indicated, provide products formulated with fungicide that are intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes, and that comply with the following:
 1. Products: Available products include the following:
 - a. 786 Mildew Resistant; Dow Corning.
 - b. Sanitary 1700; GE Silicones.
 - c. 898 Silicone Sanitary Sealant; Pecora Corporation.
 - d. Trensil 600 White; Tremco.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
 6. Applications: Where required.
- C. Single-Component Nonsag Urethane Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
 1. Products: Available products include the following:
 - a. Vulkem 116; Mameco International.
 - b. Vulkem 230; Mameco International.
 - c. DyMonic; Tremco.
 - d. NP 1; Sonneborn Building Products Div., ChemRex Inc.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 12-1/2
 4. Uses Related to Exposure: T(traffic) and NT (nontraffic)
 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

6. Applications: Sealing exterior brick veneer expansion and contraction joints, exterior curtain wall joints, door, window and panel perimeter installations. Sealing of isolation joints in concrete slabs.
- D. Multicomponent-Component Nonsag Urethane Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Available products include the following:
 - a. Vulkem 922; Mameco International.
 - b. Dynatrol; Pecora Corporation..
 - c. Dymeric 511; Tremco.
 - d. NP 2; Sonneborn Building Products Div., ChemRex Inc.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Uses Related to Exposure: NT (nontraffic)
 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 6. Applications: Sealing joints of EIFS System.
- E. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Available products include the following:
 - a. Chem-Calk 600: Bostik. Inc.
 - b. AC-20; Pecora Corporation..
 - c. Tremflex 834; Tremco.
 - d. Sonolac: Sonneborn Building Products Div., ChemRex, Inc..
 2. Applications: Filling voids to be painted between gypsum board, concrete masonry units, pipes, toilet fixtures, interior door and window frames, and ceiling-to-wall joints.
- F. Butyl-Rubber-Base Solvent-Release Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Available products include the following:
 - a. Bostik 300; Bostik. Inc.
 - b. BC-158; Pecora Corporation..
 - c. Tremco Butyl Sealant; Tremco.
 - d. Sonneborn Multi-Purpose Sealant;
 - e. Sonneborn Building Products Div., ChemRex, Inc..
 2. Applications: Bedding thresholds and seals subject to water.

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Steel doors.
2. Steel door frames.
3. Borrowed-light frames.
4. Fire-rated door and frame assemblies.

- B. Related Sections include the following:

1. Division 8 Section "Flush Wood Doors" for wood doors installed in steel frames.
2. Division 8 Section "Door Hardware (Scheduled by Describing Products)" for door hardware and weather stripping.
3. Division 8 Section "Glazing" for glass in glazed openings in doors and frames.
4. Division 9 Section "Gypsum Board Assemblies" for spot-grouting frames installed in steel-framed gypsum board partitions.
5. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.3 DEFINITIONS

- A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

- A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

- B. Shop Drawings: Show the following:

1. Elevations of each door design.
2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Coordination of glazing frames and stops with glass and glazing requirements.

- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for factory-finished doors and frames.
- D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.5 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- B. Fire-Rated Door Assemblies: Assemblies 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Steel Doors and Frames:
 - a. Amweld Building Products, Inc.
 - b. Ceco Door Products; a United Dominion Company.
 - c. Curries Company.
 - d. Mesker Door, Inc.
 - e. Republic Builders Products.
 - f. Steelcraft; a division of Ingersoll-Rand.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.
- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush), 18-gauge minimum.
- C. Deleted.

2.4 FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames of 0.053-inch-thick steel sheet for:
 - 1. Door openings wider than 48 inches.
 - 2. Level 2 steel doors.
 - 3. Level 3 steel doors, unless otherwise indicated.
 - 4. Wood doors, unless otherwise indicated.
- C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- D. Plaster Guards: Provide 0.016-inch-thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.
- E. Supports and Anchors: Fabricated from not less than 0.042-inch-thick, electrolytic zinc-coated or metallic-coated steel sheet.
 - 1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

- F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, insulated panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
- C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:
 - 1. Cold-rolled steel sheet.
- D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
- E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.
- F. Clearances for Fire-Rated Doors: As required by NFPA 80.
- G. Single-Acting, Door-Edge Profile: Square edge.
- H. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- I. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- K. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of **0.13 Btu/sq. ft. x h x deg** or better.
- L. Sound-Rated (Acoustical) Assemblies: Where shown or scheduled, provide door and frame assemblies fabricated as sound-reducing type, tested according to ASTM E 1408, and classified according to ASTM E 413.
 - 1. Where indicated, provide acoustical assemblies with STC sound ratings of **33** or better.
- M. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier.

Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

N. Frame Construction: Fabricate frames to shape shown.

1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
2. For exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints. Exterior frames to be thermally broken.

O. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

P. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

Q. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- thick steel sheet.

1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

R. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.6 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

2.7 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
3. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.

4. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
 5. Install fire-rated frames according to NFPA 80.
- C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
1. Fire-Rated Doors: Install within clearances specified in NFPA 80.

2.8 ADJUSTING AND CLEANING

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Factory finished flush wood doors.
- 2. Flush wood doors with view glass.
- 3. Fire-rated flush wood doors.

- B. Related Sections include the following:

- 1. Division 8 Section "Steel Doors and Frames" for metal door frames.
- 2. Division 8 Section "Finish Hardware" for door hardware installed on flush wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. For doors to receive a transparent stain factory finish. Provide initial samples 4" x 12" for architect to select from manufacturer's standard colors of stain. Provide (2) samples 12" x 12" for final finish approval. Samples will be used as standard of reference for doors.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate doors to be factory finished and finish requirements.
 - 4. Indicate fire ratings for fire doors.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain prefinished flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors" and AWI's "Architectural Woodwork Quality Standards Illustrated."

- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - 1. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.
- D. Clearly show labels at all rated doors.

1.6 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 will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Reference AWI quality standard including Section 100-S-3 "Moisture Content."

1.7 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, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 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. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Flush Wood Doors:

- a. Algoma Hardwoods Inc.
- b. Eggers Industries; Architectural Door Division.
- c. Marshfield Door Systems.
- d. VT Industries Inc.
- e. Oshkosh

2.2 SOLID-CORE DOORS

- A. Doors shall be prefinished plain sliced Red Oak, veneered. Field verify selection with existing doors on restrooms in FEMA Building.**
- B. Particleboard Cores: Comply with the following requirements:
1. Particleboard: ANSI A208.1, Grade LD-1.
 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 3. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
- C. Fire-Rated Doors:
1. Doors to be plain sliced Red Oak veneered.
 2. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
 3. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
 4. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
 5. Pairs: Furnish formed-steel edges and astragals with intumescent seals for pairs of fire-rated doors, unless otherwise indicated.

2.3 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors:
1. Wood Species: Same species as door faces.
 2. Profile: Manufacturer's standard shape.
 3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.4 FABRICATION

- A. Fabricate doors in sizes indicated.

- B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 - 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- 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. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Louvers: Factory install louvers in prepared openings.

2.5 SHOP PRIMING

- A. Doors for Opaque Finish: Shop prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Division 9 Section "Painting."

2.6 FACTORY FINISHING

- A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.
- B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
- C. Transparent Finish:
 - 1. Grade: Custom.
 - 2. Finish: NWWDA I.S.1-A System TR-6 catalyzed polyurethane.
 - 3. Finish: AWI System TR-6 catalyzed polyurethane.
 - 4. Staining: As selected by Architect to match sample provided.
 - 5. Effect: Filled finish.
 - 6. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. 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 for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch 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 at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- F. Field-Finished Doors: Refer to the following for finishing requirements:
 - 1. Division 9 Section "Painting."

3.3 ADJUSTING

- A. Operation: Re-hang 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 08211

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work of this section.

1.2 DESCRIPTION OF WORK:

- A. Finish Hardware: This Specification is to establish performance quality. The work of this Section includes the complete installation of all items of Finish Hardware and shall consist generally of the following:

1. Receive, store and be responsible for all Finish Hardware. Properly tag, index and file all keys, or as directed.
2. Apply hardware in accordance with manufacturer's instructions, fit accurately, apply securely and adjust carefully. Use care not to injure work when applying hardware. When necessary, remove and replace doors so they may have top and bottom painted.

- B. Definition: "Builders Hardware" includes items known commercially as builders hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

- C. Types of finish hardware required include the following:

- Hinges
- Lock cylinders and keys
- Lock and latch sets
- Bolts
- Push/pull units
- Closers
- Door trim units
- Protection plates
- Panic hardware
- Astragals or meeting seals on pairs of doors
- Silencers included integral with hollow metal frames are specified with door frames elsewhere in Division 8.

- D. Hardware and Installation shall comply with IBC 2003, Chapter 11.; ANSI 117.1, Americans with Disabilities Act and Architectural Barriers Act Guidelines, June 2005 Edition. This Section requires the Contractor to verify finish hardware and its installation to be in compliance with the above stated standards and notify the Architect of non compliant conditions prior to procurement and installation of finish hardware.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each item of hardware in accordance with Division 1. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.
- B. Hardware Schedule: Submit final hardware schedule in manner indicated below. Coordinate

hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.

- C. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
1. Type, style, function, size and finish of each hardware item.
 2. Name and manufacturer of each item.
 3. Fastenings and other pertinent information.
 4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 5. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 6. Mounting locations for hardware.
 7. Door and frame sizes and materials.
 8. Keying information.
- D Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- E. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.4 QUALITY ASSURANCE:

- A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from only one manufacturer, although several may be indicated as offering products complying with requirements.
- B. Supplier: A recognized architectural finish hardware supplier with warehousing facilities in the project's vicinity who is, or who employs, an experienced architectural consultant who is available at reasonable times during the course of the work for consultation with the Owner, Architect, and Contractor about the project's hardware requirements.
- C. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels.
1. Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".

1.5 PRODUCT HANDLING:

- A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of hardware is the responsibility of the supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory hardware jointly with representatives of the hardware supplier and the hardware installer until each is satisfied that the count is correct.
- D. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.
- E. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION:

A. General:

1. 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.
2. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for the applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
3. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
4. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
5. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of the type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on the opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex screw fasteners.

2.2 KEYING AND KEY CONTROL:

All keying is to be per Owner's instructions.

A. General:

1. All lock cylinders and keyed exit devices shall be keyed in keysets, master keyed and grand master keyed as directed by Owner.
2. All lock cylinders shall be construction keyed to construction master key for the contractor's usage during construction period. Construction key system shall permit voiding of construction keys without cylinder removal from the lockset.
3. All permanent keying of key cylinders shall be determined in a key conference attended by representatives of the Owner, Hardware Supplier, and lock manufacturer.
4. The key conference shall be scheduled by the Hardware Supplier at the earliest opportunity in order for the supplier to obtain final approval of lock keying before ordering hardware.
5. All keys shall be inscribed with Key Set Symbol and the inscription "Do Not Duplicate." Furnish keys in the following listed quantities:
 - (2) Day or Change Keys per lock cylinder
 - (3) Master Keys per master Key Set
 - (3) Grand Master Keys for the building
 - (6) Construction Master Keys for the contractor's use at the job site.
6. Furnish one (1) Key Cabinet, Lund #1203A Deluxe Wall Cabinet complete with Two Tag Key System. Key capacity of 200 Keysets.
7. Key Cabinet to be mounted by the General Contractor in location as directed by the Architect.
8. At the end of the construction period, General Contractor shall provide the individual lock keys to the Owner, each tagged with its respective door number. The contractor shall demonstrate to the Owner that each individual key operates its respective lockset. This must be done at the end of the construction period, as this procedure will void the Construction Master Key.

2.3 HINGES:

- A. General: Door hinges shall be of the ball bearing, five knuckle, full mortise type. Finish shall be as shown on the drawings; if not shown, use US26D on interior doors, US32D/NRP on exterior doors.

2.4 LOCKS, LATCHES, AND BOLTS:

- A. General: Door operation hardware shall be of medium duty commercial grade, with lever handles compliant with the Americans with Disabilities Act. Hardware shall meet ANSI A156.2, Series 4000, Grade 1 requirements. Unless otherwise noted, hardware finish for locksets shall be US26D.
- B. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.
- C. Lock Throw: Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

- D. Flush Bolts: shall be mortise extension type with mortise strikes (ASA Standard).
- E. Flush Bolt Heads: Minimum of 1/2" diameter rods of brass, bronze or stainless steel, with minimum 12" long rod for doors up to 7'- 0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.
- F. Exit Devices: shall be rim type surface applied with cylinder and lever handle holes prepared by door supplier to template.
- G. Exit Device Dogging: Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position.
- H. Door Stop: Wall mounted unless approved otherwise.

2.5 PUSH/PULL UNITS:

- A. Concealed Fasteners: Provide manufacturer's special concealed fastener system for installation; through-bolted for matched pairs, but not for single units.

2.6 CLOSERS AND DOOR CONTROL DEVICES:

- A. Door Closers: shall be surface door mounted closers unless otherwise noted on Plans.
 - 1. Provide parallel arms for all overhead closers, except as otherwise indicated.
- B. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use. All interior closers except those mounted on fire doors shall be adjustable to comply with maximum door opening force of five pounds, as determined by procedures set forth in the Americans with Disabilities Act.

2.7 DOOR TRIM UNITS:

- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates and similar units); either machine screws or self-tapping screw.
 - 1. Fabricate protection plates (armor, kick or mop) not more than 2" less than door width on stop side and not more than 1/2" less than door width on pull side x the height indicated.

2.8 HARDWARE FINISHES:

- A. General:
 - 1. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
 - 2. Provide finishes which match those established by BHMA or, if none established, match the Architect's sample.

3. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General:

1. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.
2. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
3. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
4. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.2 ADJUST AND CLEAN:

A. General:

1. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
2. Clean adjacent surfaces soiled by hardware installation.
3. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

- B. Final Adjustment: Approximately one week prior to the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

Finish Hardware Schedule Follows:

OTC RICHWOOD VALLEY CAMPUS FEMA SHELTER INFILL

REKEY EXISTING DOORS AS DIRECTED BY OWNER.

SET 1 DR. 105, 106, 107, 108, 116, 117, 125, 126, 127

3 EA. HINGES	BB1279 4 ½ X 4 ½ 626	H
1 LOCK	10-G37 LL 626	S
1 WALL STOP	406 US32D	R

SET 2 DR. 110, 113, 114, 115, 118

3 EA. HINGES	BB1279 4 ½ X 4 ½ 626	H
1 LOCK	10-G37 LL 626	S
1 CLOSER	7500 689 SNB	N
1 KICKPLATE	8 X 34 US32D	R
1 WALL STOP	406 US32D	R

SET 3 DR. 103

6 EA. HINGES	BB1279 4 ½ X 4 ½ 626	H
1 LOCK	10-G04 LL 626	S
2 FLUSH BOLTS	555 626	R
1 DUST STRIKE	570 626	R
2 WALL STOP	406 US32D	R

SET 4 DR. 104 (45-MINUTE RATED ASSEMBLY)

3 EA. HINGES	BB1279 4 ½ X 4 ½ 626	H
1 LOCK	10-G37 LL 626	S
1 CLOSER	7500 689 SNB	N
1 KICKPLATE	8 X 34 US32D	R
1 WALL STOP	406 US32D	R
1 SMOKE SEAL		

OWNER TO PROVIDE AND INSTALL ALL CYLINDERS AND KEYING FOR LOCKS.

END OF SECTION 08710

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Interior borrowed lites.
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants"

1.3 DEFINITIONS

- A. **Manufacturer:** A firm that produces primary glass or fabricated glass as defined in referenced glazing publications. Engineering required to achieve performance requirements is a part of the manufacturer's work.
- B. **Interspace:** Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. **Deterioration of Coated Glass:** Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- D. **Deterioration of Laminated Glass:** Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
- E. **Deterioration of Insulating Glass:** Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Comply with **IBC 2012**, Chapter 24, and as specified herein:
1. Section 2403 for general requirements.
 2. Section 2404 for wind, snow, seismic, and dead load requirements.
 3. Section 2406 for safety glass.
- C. Glass Design: Glass thicknesses indicated are minimums and are for bid and detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: 90 MPH.
 - b. Specified Design Snow Loads: 35 PSF, but not less than snow loads applicable to Project, required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7, "Snow Loads."
 - c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
 - 1) Load Duration: 30 days.
 - e. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
 - f. Thickness of Tinted Glass: Provide the same thickness for each tint color indicated throughout Project.
- D. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.

- B. Samples: For the following products, in the form of 12-inch- square Samples for glass and of 12-inch- long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- C. Samples: For the following products, in the form of 12-inch- square Samples for glass.
 - 1. Each color of tinted float glass.
 - 2. Ceramic-coated spandrel glass.
 - 3. Each type of laminated glass with colored interlayer.
 - 4. Insulating glass for each designation indicated.
 - 5. Sandblasted translucent panels.
- D. Color options from manufacturers: Standard options to allow Architect and Owner to refine selection choices at the time of product submittal based on the successful bidder's manufacturer.
- E. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- F. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.
- C. Source Limitations for Tinted Glass: Obtain tinted, heat-absorbing, and light-reducing float glass from one primary-glass manufacturer for each tint color indicated.
- D. Source Limitations for Insulating Glass: Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.
- E. Source Limitations for Laminated Glass: Obtain laminated-glass units from one manufacturer using the same type of glass lites and interlayers for each type of unit indicated.
- F. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- G. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
 - 1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
- H. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."

2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

Warranty Period: 10 years from date of Substantial Completion.

- C. Manufacturer's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass manufacturer agreeing to furnish replacements for laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: Five years from date of Substantial Completion.
- D. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in schedules at the end of Part 3.

2.2 PRIMARY FLOAT GLASS

- A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

2.3 HEAT-TREATED FLOAT GLASS

- A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

2.4 INSULATING GLASS

- A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.
2. All interior insulating glazing to be clear.

- B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

- C. Sealing System: Dual seal, with primary and secondary sealants as follows:

1. Manufacturer's standard sealants.

- D. Spacer Specifications: Manufacturer's standard spacer material and construction.

1. Aluminum with mill or clear-anodized finish.
2. Desiccant: Molecular sieve or silica gel, or blend of both.
3. Corner Construction: Manufacturer's standard corner construction.

2.5 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.
- B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant in the Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.7 GLAZING GASKETS

- A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
1. Neoprene.
 2. EPDM.
 3. Silicone.
 4. Thermoplastic polyolefin rubber.
 5. Any material indicated above.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.9 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 SEALANT GLAZING (WET)

1. Products: Available products include the following:
 - a. 790; Dow Corning.
 - b. Silpruf; GE Silicones.
 - c. 864; Pecora Corporation.
 - d. Spectrem 1; Tremco.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
- B. Medium-Modulus Neutral-Curing Silicone Glazing Sealant GS-[#]: Where glazing sealants of this designation are indicated, provide products complying with the following:
1. Products: Available products include the following:
 - a. 756 H.P.; Dow Corning.
 - b. Silglaze II; GE Silicones.
 - c. 895; Pecora Corporation.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.

END OF SECTION 08800

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Interior gypsum wallboard.
2. Tile backing panels.
3. Non-load-bearing steel framing.
4. Suspended acoustical elements.

- B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing integral with drywall.
2. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in gypsum board assemblies.
3. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for framing, gypsum panels, and other components of shaft wall assemblies.
4. Division 9 Section "Ceramic Tile" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work. Coordinate final location and extent of joints at the preconstruction conference. Do not proceed with installation without the architect's approval of joint layout.

- C. Samples: For the following products:

1. Trim Accessories: Full-size sample in 12-inch- long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory."GA-600, "Fire Resistance Design Manual."
- B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
 - 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."
- C. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Install mockups for the following applications:
 - a. Surfaces with texture finishes.
 - b. Surfaces indicated to receive non-textured paint finishes.
 - c. Surfaces indicated to receive textured paint finishes.
 - 2. Simulate finished lighting conditions for review of mockups.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Framing and Furring:
 - a. Clark Steel Framing Systems.
 - b. Consolidated Systems, Inc.
 - c. Dale Industries, Inc. - Dale/Incor.
 - d. Dietrich Industries, Inc.
 - e. MarinoWare; Division of Ware Ind.
 - f. National Gypsum Company.
 - g. Scafco Corporation.
 - h. Unimast, Inc.
 - i. Western Metal Lath & Steel Framing Systems.
2. Gypsum Board and Related Products:
 - a. American Gypsum Co.
 - b. G-P Gypsum Corp.
 - c. National Gypsum Company.
 - d. United States Gypsum Co.

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 754 for conditions indicated.
- B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- C. Hanger Attachments to Concrete: As follows:
 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to [5] times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to that recommended by qualified installer and imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- D. Hangers: As recommended by the manufacturer for the application and/or As follows:
 1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
 2. Rod Hangers: ASTM A 510, mild carbon steel.
 - a. Diameter: [1/4-inch] .
 - b. Protective Coating: [ASTM A 153/A 153M, hot-dip galvanized]
 3. Flat Hangers: Commercial-steel sheet, [ASTM A 653/A 653M, G40, hot-dip galvanized]
 - a. Size: [1 by 3/16 inch by length indicated]
 4. Angle Hangers: ASTM A 653/A 653M, [G60] hot-dip galvanized commercial-steel sheet.
 - a. Minimum Base Metal Thickness: As recommended.

- b. Size: 1-5/8 by 1-5/8 inches.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with [manufacturer's standard corrosion-resistant] zinc coating.
- 1. Depth: As recommended by the manufacturer for the application, but not less than 2 inches.
- F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized, ASTM A 653/A 65, manufacturer's standard corrosion-resistant zinc coating.
- 1. Cold Rolled Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange, 3/4 inch deep.
 - 2. Steel Studs: ASTM C 645.
 - a. Minimum Base Metal Thickness: As indicated.
 - b. Depth: As indicated.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: 0.0312 inch.
 - 4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: As recommended by the sound consultant: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.
- G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
 - b. Chicago Metallic Corporation; Fire Front System.
 - c. USG Interiors, Inc.; Drywall Suspension System.

2.3 STEEL PARTITION AND SOFFIT FRAMING

- A. Components, General: As follows:
- 1. Comply with ASTM C 754 for conditions indicated.
 - 2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with manufacturer's standard corrosion-resistant zinc coating.
- B. Steel Studs and Runners: ASTM C 645.
- 1. Minimum Base Metal Thickness: As indicated, 0.027 inch.
 - 2. Depth: As indicated.
- C. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.

- D. Proprietary Deflection Track: Steel sheet top runner manufactured to prevent cracking of gypsum board applied to interior partitions resulting from deflection of structure above; in thickness indicated for studs and in width to accommodate depth of studs.
1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Product: Subject to compliance with requirements, provide one of the following:
 - a. Delta Star, Inc., Superior Metal Trim; Superior Flex Track System (SFT).
 - b. Metal-Lite, Inc.; Slotted Track.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base Metal Thickness: [0.0312 inch] .
- F. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.
1. Depth: 1-1/2 inches
 2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0312 inch.
 2. Depth: As indicated.
- H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.
- I. Cold-Rolled Furring Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange.
1. Depth: As indicated.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
- K. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Wallboard: ASTM C 36.

1. Regular Type:
 - a. Thickness: As indicated.
 2. Type X: Vertical Applications; (Type C for Horiz. Applications)
 - a. Thickness: 5/8 inch as indicated.
 - b. Long Edges: Tapered.
 - c. Location: As indicated.
- C. Flexible Gypsum Wallboard: ASTM C 36, manufactured to bend to fit tight radii and to be more flexible than standard regular-type panels of the same thickness.
1. Thickness: 1/4 inch.
 2. Long Edges: Tapered.
 3. Location: As indicated; apply in multiple layers at curved assemblies.
- D. Proprietary, Special Fire-Resistive Type: ASTM C 36, having improved fire resistance over standard Type X.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum Co.; FireBloc Type C.
 - b. G-P Gypsum Corp.; Firestop Type C.
 - c. National Gypsum Company; Gold Bond Fire-Shield G.
 - d. United States Gypsum Co.; SHEETROCK Brand Gypsum Panels, FIRECODE C Core or ULTRACODE Core.
 3. Thickness: As indicated.

2.5 TILE BACKING PANELS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Fiber Reinforced Backer Units:
1. Product: Fiberock Aqua-Tough Tile Backerboard :
 - a. United States Gypsum Co.
 2. Thickness: 1/2".
 3. Application: To be installed in all toilet rooms. All joints and screw heads to be taped and finished.

2.6 GLASS FIBER REINFORCED SHEATHING: (GFR Sheathing)

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Glass Fiber Reinforced Sheathing:

1. Product: Densglass Gold Fireguard Sheathing :
 - a. Georgia Pacific Co..
2. Thickness: 5/8”.
3. Application: To be installed as substrate under all E.I.F.S. All joints and screw heads to be taped and finished with glass mesh tape in accordance with manufacturer’s recommendations for exterior applications.

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047. See also, the drawings.

1. Material: Galvanized or aluminum-coated steel sheet.
2. Shapes:
 - a. Cornerbead: Use at outside corners[, unless otherwise indicated].
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use [at exposed panel edges] .
 - c. L-Bead: L-shaped; exposed long leg receives joint compound; use at reveals where there is a change in materials.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges and where indicated.
 - e. Expansion (Control) Joint: Use [where indicated] or if not indicated, coordinate locations with the architect at the time of assembly..
 - f. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.
 - g. Decorative recessed trim. Refer to the drawings for location and type.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. MM Systems Corporation.
 - d. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B , alloy 6063-T5.
3. Finish:
 - a. Power Wall Trim and Moldings: Chemical Conversion Coat complying with ASTM D1730 Type B and MIL-C5541A.
 - b. All Other Trim and Moldings: Standard Clear Anodized complying with Architectural 200R1 etch (AA-M32C10A21).
4. Shapes:
 - a. Power Wall Reveal Molding – Fry Reglet DRM 625-625.

- b. Power Wall/Ceiling Cap - 487-PR1 by Raco Altura
- c. Power Wall Reveal Base Molding – Fry Reglet DRMB 625-400.
- d. Power Wall/Ceiling “F” Reveal Molding – Fry Reglet DRMF 625-200.
- e. All Other Trim and Moldings: See Drawings for specific installation.

2.8 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 1. Interior Gypsum Wallboard: Paper.
 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use all-purpose compound.
 3. Fill Coat: For second coat, use setting-type, all-purpose compound.
 4. Finish Coat: For third coat, use setting-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
 1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
 2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
 3. Cementitious Backer Units: As recommended by manufacturer.

2.9 ACOUSTICAL SEALANT

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.10 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick, or as recommended by the manufacturer for the unique conditions shown.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Isolation Strip at Exterior Walls:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.
- E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."
- G. Polyethylene Vapor Retarder: As specified in Division 7 Section "Building Insulation."

2.11 TEXTURE FINISHES

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Texture: All gypsum board finishes shall be taped and finished smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
 - 1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
 - 2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
 - a. Use deep-leg deflection track where indicated.
 - b. Use proprietary deflection track where indicated.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 - 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 - 4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to steel deck tabs.
 - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within $1/8$ inch in 12 feet measured lengthwise on each member and transversely between parallel members.
- C. Sway-brace suspended steel framing framing details for exterior soffits on Drawings.
- D. Screw furring to wood framing.

- E. Wire-tie [or clip furring channels to supports], as required to comply with requirements for assemblies indicated].
- F. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
 - 1. Hangers: 48 inches unless indicated otherwise or recommended by manufacturer for the unique application.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 16 inches.
- G. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
 - 1. Where studs are installed directly against exterior walls, install [foam-gasket isolation strip between studs and wall.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
 - 1. Cut studs 1/2 inch short of full height to provide perimeter relief.
 - 2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
 - a. Install steel studs and furring at the following spacings or as Indicated:
 - 3. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
 - 4. Multilayer Construction: 12 inches o.c., unless otherwise indicated.
 - 5. Cementitious Backer Units: 16 inches o.c., unless otherwise indicated.
- D. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
- E. Curved Partitions:
 - 1. Cut top and bottom track (runners) through leg and web at 2-inch intervals for arc length. In cutting lengths of track, allow for uncut straight lengths of not less than 12 inches at ends of arcs.
 - 2. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - 3. Support outside (cut) leg of track by clinching steel sheet strip, 1-inch- high-by-thickness of track metal, to inside of cut legs using metal lock fasteners.

4. Begin and end each arc with a stud, and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
1. Install two studs at each jamb, unless otherwise indicated.
 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- H. Z-Furring Members:
1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
 4. Until gypsum board is installed, hold insulation in place with 10-inch staples fabricated from 0.0625-inch-diameter, tie wire and inserted through slot in web of member.
- I. Polyethylene Vapor Retarder: Install to comply with requirements specified in Division 7 Section "Building Insulation."

3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.
- I. Form control and expansion joints with space between edges of adjoining gypsum panels.
- J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- L. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
- M. STC-Rated Assemblies and assemblies indicated to be sound isolation walls: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
- O. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.7 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels at contractor's choice -- vertically (parallel to framing), horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

- a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Multilayer Application on Ceilings: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
- C. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
- D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- E. Multilayer Fastening Methods: As recommended by the manufacturer.
- F. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- G. Curved Partitions:
 1. Install panels horizontally and unbroken, to the extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
 2. Wet gypsum panels on surfaces that will become compressed where curve radius prevents using dry panels. Comply with gypsum board manufacturer's written recommendations for curve radii, wetting methods, stacking panels after wetting, and other preparations that precede installing wetted gypsum panels.
 3. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum panels to studs as they are wrapped around curve. On concave side, start fastening panels to stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced 12 inches o.c.
 4. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
 5. Allow wetted gypsum panels to dry before applying joint treatment.
- H. Tile Backing Panels:
 1. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.
 2. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated to receive tile.
 3. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

4. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings and Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges,] and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where [panels are substrate for tile and where indicated].
 3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges..
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.10 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture [matching approved mockup and] free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

3.11 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
1. Notify Architect to allow review to be concurrent with regularly scheduled project meeting.
 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation, insulation, and leak and pressure testing of water piping systems.
 - b. Installation of air-duct systems.
 - c. Installation of air devices.
 - d. Installation of mechanical system control-air tubing.
 - e. Installation of ceiling support framing.

END OF SECTION 09260

SECTION 09310 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. **Ceramic tile is provided by the owner.** The Contractor shall provide all adhesives and accessories, and the labor to achieve a finish installation. Information herein is for scope of the work and performance expectations to achieve a quality finish and installation.
- B. This Section includes the following:
 - 1. Porcelain Ceramic Mosaic Tile.
 - 2. Porcelain Ceramic tile.
- C. Related Sections include the following:
 - 1. Caulking and Sealants, Section 07920.
 - 2. Gypsum Board Assemblies, Section 09260.
 - 3. See Finish Schedule on Drawings.

1.3 SUBMITTALS

- A. Product Data: For each type of tile, mortar, grout, and other products specified.
- B. Shop Drawings: For the following:
 - 1. Tile patterns and locations.
 - 2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.
- D. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
- E. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
 - 1. Each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.
 - 2. Full-size units of each type of trim and accessory for each color required.

- F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- G. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.
- H. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.
- I. Tile Test Reports: Indicate and interpret test results for compliance of special-purpose tile with specified requirements.
- J. Setting Material Test Reports: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

1.4 QUALITY ASSURANCE

- A. Mockups: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
 - 1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's approval of mockups before proceeding with final unit of Work.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. When directed, demolish and remove mockups from Project site.
 - b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.
- B. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
- C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.
- D. Clean and remove any excess material and dry powder from tile backs.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.7 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those provided as indicated below.

2.2 PRODUCTS, GENERAL

- A. Reference manufacturer is DalTile. Provide products to match tile selection in existing building. Reference Finish Schedule on drawings.
- B. ANSI Ceramic/Porcelain Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- C. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.
- D. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - 1. Match Architect's samples.
 - 2. Match colors, textures, and patterns indicated by referencing manufacturer's standard designations for these characteristics.
 - 3. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
 - 4. Provide tile trim and accessories that match color and finish of adjoining flat tile.
- E. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the field as it is being installed from a minimum of four boxes.

- F. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.
 - 1. Where tile is indicated for installation in swimming pools, on exteriors, or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for these kinds of installations and has a record of successful in-service performance.
- G. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 MORTAR, THINSET AND GROUT

- A. Materials for installing and grouting porcelain ceramic tiles shall be manufactured by Bonsal American.
 - 1. Thinset/Mortar: Bonsal Superior Permaflox (500).
 - a. Shall exceed ANSI A.118.4 for Latex Portland Cement Mortar and A.118.11 for EGP Latex Portland Cement Mortar.
 - b. Thinset/Mortar specified above shall be used in both horizontal and vertical installations
 - 2. Grout: Bonsal Superior Unsanded Tile Grout (800) Polymer Modified
 - a. Meets ANSI A118.6
 - b. Grout specified above shall be used in both horizontal and vertical installations. Joints are to be flush and smooth to minimize depressions.

2.4 ANTI-FRACTURE/CRACK SUPPRESSION MEMBRANE

- A. Materials for installing anti-fracture/crack suppression membrane shall be manufactured by National Applied Constructions Product, Inc. Note: Membrane is required in public spaces only, it is not required in the bathrooms.
 - 1. Anti-fracture/Crack Suppression Membrane: ECB "Elastomeric Crack Bridging Membrane"
 - a. 40 mil, thick load bearing membrane, capable of 3/8" lateral crack suppression
 - b. Self bonding, pressure-sensitive sheet.
 - c. Compatible with latex modified thinsets and mortar, epoxies and adhesives.
 - d. In all Toilet Rooms, provide NAC NS97 Primer.
 - e. In all other locations, provide NAC TAC Primer.
 - f. Product shall be installed at all floor tile locations in full 36" wide rolls to achieve full floor coverage and in accordance with manufacturer's recommendations for "10 Year Fracture Free" Warranty.

2.5 METAL EXPANSION JOINT/CONTROL JOINT & EDGE PROTECTION TRIM

- A. Materials for installing metal expansion joint/control joint shall be manufactured by Blanke Corporation.
1. Expansion Joints/Control Joints:
 - a. Locations shall be as required per manufacturer's recommendations.
 - b. Expansion Joints/Control Joints shall be equal to Aluminum "Heavy Duty Expansion Joint" with brown silicone sealant. Material # 335 408 100.
 - c. Adhesive for Expansion Joints/Control Joints shall be recommended by manufacturer for use intended.
 2. Edge Protection Trim:
 - a. Trim shall be installed at tile/carpet transitions and as indicated on drawings.
 - b. Edge Protection Trim shall be equal to Aluminum "Edge Protection Trim". Material # 300 400 10025.
 - c. Adhesive for Edge Protection Trim shall be recommended by manufacturer for use intended.

PART 3 - EXECUTION

3.1 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.
- B. Substrate for all wall tile installations shall be fiber reinforced gypsum panels equal to "Fiberock Aqua-Tough" tile backerboard, and is specified in Section 09260. All backerboard joints and screwheads shall be taped and finished smooth.
- C. All floor tile shall be install on Anti-fracture/Crack Suppression Membrane specified above.
- D. Joint Widths: Install tile on floors and walls with the following joint widths:
1. Mosaic: 1/32 inch.
 2. Ceramic Tile: 1/16 inch.

3.2 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove latex-portland cement grout residue from tile as soon as possible.
 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect

- metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure tile is without damage or deterioration at the time of Substantial Completion.
1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

END OF SECTION 09310

SECTION 09510 - ACOUSTICAL CEILING

PART 1. GENERAL

1.1 PROVISIONS

- A. Requirements of the General Provisions apply to all work under this section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition.

1.2 DESCRIPTION

- A. Work covered by this section includes furnishing of and paying for all materials, labor, equipment, licenses, completion of all work under this section.
- B. The work described in this section of the specifications includes, but is not limited to, the following:
 - 1. Acoustical Treatment consists of Suspension System Ceiling Tile and Panels and all necessary accessories.

1.3 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Other sections of work as covered under finishes, Division 9.
 - 2. Mechanical, Division 15.
 - 3. Electrical, Division 16.

1.4 QUALIFICATIONS

- A. Acceptable manufacturers of acoustical tile are as follows:
 - 1. Armstrong Contract Interiors
 - 2. Celotex
 - 3. USG Interiors, Inc.
 - 4. CertainTeed

1.5 SUBMITTALS

- A. Submit to the Architect for approval drawing showing layout of suspension system and tile, incorporating light fixtures, grilles and other items mounted through or on acoustical ceiling.
- B. Submit manufacturer's descriptive literature for all materials to be used.
- C. Submit duplicate, full-size samples of each ceiling tile type, pattern and color. See Finish Schedule and Ceiling Type Schedule on Drawings.

1.6 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Provide acoustical ceiling components that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate marking of applicable testing and inspecting agency.

- B. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, fire-suppression system components and partition system.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers, labeled so as to allow easy identification.
- B. Store materials in fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.8 ENVIRONMENTAL CONDITIONS

- A. Temperature of 60 degrees F minimum to 80 degrees F maximum shall be maintained continuously for 24 hours before, during, and after installation of acoustical tile.

1.9 EXTRA STOCK

- A. Furnish quantity of full-size acoustical tiles and suspension system components equal to (5%) Five percent of amount installed for "attic stock."

PART 2. PRODUCTS

2.1 SUSPENDED ACOUSTICAL TILE CEILING WITH SUSPENSION SYSTEM

- A. See Reflected Ceiling Plans, for ceiling tile selection.
- B. Standard for Acoustical Tile Ceiling Units: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade (NRC or NIC's as applicable), light reflectance coefficient (LR), edge detail, and joint detail.
- C. Mounting Method for Measuring NRC: No. 7 (mechanically mounted on special metal support), FS SS-S-118; or Type E-400 mounting as per ASTM E 795.
- C. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

2.2.1 SCHEDULE OF CEILING PANEL TYPES

1. C1: 24" x 24" x 5/8" Square Edge, "Sand Micro" by CertainTeed (SHM-157); with exposed tee; color: White.

PART 3. EXECUTION

3.1 INSTALLATION

- A. Lay out work as shown on approved shop drawings with layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans whenever possible.
- B. Hangers for main runners shall be securely attached to supporting structure and spaced 4'-0" o.c. Hangers shall be mounted using hanger inserts, or other hanger attachment devices whose suitability has been demonstrated by Standard Construction Practice or by Certified Test Data.
- C. Main runners shall be spaced as indicated and level within 1/8" in 10'. Local kinks or bends shall not be made in hanger wires as a means of leveling main runners. Wire hanger loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops.
- D. Wall mouldings shall be provided at the perimeter of all rooms and shall be securely fastened to walls or as indicated. Finish channel corner plates shall be used at all exterior corners. Channel flanges shall be cut, the web bent, and flanges overlapped to form interior corners.
- D. Install tile according to manufacturer's instructions keeping joints tight, parallel, and even with tile pattern all running in same direction. Marked changes in texture of tile will not be acceptable.
- F. Locate access panels as indicated.
- G. Comply with governing regulations, fire resistance rating requirements as indicated, and CISCA standards applicable to work.
- H. Arrange acoustical units and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans.
- I. Install directional tile with pattern running same direction as indicated by the arrows on the back to give a continuous appearance.

3.2 CLEANING

- A. Tile, trim, edge mouldings, and suspension members shall be clean and without blemish at time of acceptance and shall comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.
- B. At the completion of the finished acoustical ceiling work, remove all rubbish from the building, leaving floors broom clean. Excess material, scaffolding, tools, and other equipment shall be removed from the building and jobsite.

END OF SECTION 09510

SECTION 09650 - RESILIENT FLOORING AND BASE

PART 1. GENERAL

1.1 PROVISIONS

- A. **Resilient base is provided by the Owner.** Work within this contract requires the Contractor to provide adhesives and accessories, labor, scheduling, and installation of products as a part of the work.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards for appearance, quality and performance and not for the purpose of limiting competition. Specific material and color selections will be made at the Architect's discretion from among comparable products that fall within the allowances.

1.2 DESCRIPTION

- A. Work covered by this section includes furnishing of and paying for all materials, labor, equipment, licenses, taxes, and other items required for execution and completion of all work under this section.
- B. The work described in this section of the specifications includes, but is not limited to the following:
 - 1. Resilient Wall Base.
 - 2. Related accessories.
 - 3. Finish Schedule Section 09970.

1.3 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Gypsum Board Assemblies, Section 09260.

1.4 SUBMITTALS

- A. Submit for approval manufacturer's complete descriptive data, including installation and maintenance instructions for all products to be used.
- B. Submit three (3) duplicate samples of colors selected to the Architect for final approval of color and material.

1.5 DELIVERY

- A. Deliver materials in manufacturer's original, unopened, containers, labeled so as to allow easy identification.

1.6 TEMPERATURE

- A. Keep materials, base adhesives, and spaces to receive material at 70 degrees F. minimum for 48 hours before, during, and for 48 hours after installation.

1.7 EXTRA MATERIAL

- A. Provide twenty lineal feet of rubber wall base for Owner's future use for each type, color, and pattern installed.

PART 2. PRODUCTS

2.1 MATERIALS

- A. See Finish Schedule for Resilient Base locations.
- B. Related accessories shall conform to the following:
 - 1. Reducer and trim strips shall be installed where resilient flooring abuts carpeted, unfinished areas, or other hard surface to make a transition. Products shall be equal to Roppe in quality and in colors as selected by Architect.

PART 3. EXECUTION

Comply with floor manufacturer's recommendations for type(s) of materials, project conditions, and intended use.

3.1 CONDITION OF SURFACES

- A. Clean floors and apply leveling compound and substrate primer if required, in accordance with flooring manufacturer's instructions.

3.2 PREPARATION

- A. Lay tile flooring from center marks established with principal walls; adjust as required to avoid use of cut units less than 1/2 tile wide at perimeters. Match tiles for color and pattern by using in manufactured and packaged sequence.

3.3 INSTALLATION

- A. Lay vinyl composition tile with grain running in same direction.
- B. Apply wall base in lengths as long as practicable to walls, columns, and all permanent fixtures where indicated. Install continuous coil lengths instead of in 4'-0" sections unless noted otherwise. Mitered outside corners are not acceptable.
- C. Install resilient edge strips at edges of resilient flooring which would otherwise be exposed.

3.4 CLEANING

- A. Clean floors and accessories after installation and apply protective polish in accordance with flooring manufacturer's instructions. Omit polish on "no-wax" flooring and tile indicated for "no-wax maintenance."

END OF SECTION 09650

SECTION 09680 – CARPET TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Section, apply to this Section.

1.2 DESCRIPTION OF WORK

- A. **Carpet Tile is provided by the Owner.** Work in this contract includes but is not limited to providing accessories, labor, scheduling, and installation.
- B. All bidders shall quote in accordance with the exact specifications as detailed in this document. All bidders must submit all products, specifications, product testing, and all warranties. All information must be submitted to architect in accordance with Section 01600.

1.3 DELIVERY AND STORAGE

- A. Deliver all materials to the installation site in the manufacturer's original packaging. Packaging to contain manufacturers name, identification number and related information.
- B. Product to be delivered as required by manufacturer.
- C. All materials are to be delivered (24 hours) before the start of installation and stored in (above 65 degrees F and below 95 degrees F), dry location, safe from damage and soiling. (Do not stack pallets of carpet tile.)
- D. Delivered and stored materials must be available for inspection as required by the owner, architect, general contractor, and/or the manufacturer.

1.4 INSTALLATION QUALITY ASSURANCE

- A. Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in the installation of these materials.
- B. Flooring contractor and his/her sub-contractors must be approved by the architect and/or the carpet manufacturer.
- C. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive carpet. The carpet installation standard will be as listed in The Carpet and Rug Institute's **Standard for Installation of Commercial Carpet CRI-104**. This standard establishes the minimum installation procedures.
- D. Flooring contractor to provide owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after job completion.

- E. Carpet manufacturer to provide field service experts to assist in project start-up as required by the job. Manufacturer will notify owner, architect, general contractor, or another designated contact if any installation instructions are not followed.
- F. Qualifications of Installers: All work shall be done by installation firms specializing in commercial carpet installation. It is required, that the firm shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Floor Covering Installation Board (FCIB).

1.5 JOB CONDITIONS

- A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document. Sub-floor preparation shall meet all conditions as specified in the manufacturer's installation handbook instructions.
- B. Sub-floor preparation will include, as required, the removal and repair of the existing floor surface.
- C. Carpet installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved, and completed.
- D. Site conditions shall include those specified in the carpet manufacturer's installation manual and shall also include sufficient heat, light, and power required for effective and efficient working condition.
- E. Substrate Conditions: No condensation within 48 hours on underside of 4-foot by 4-foot polyethylene sheet, fully taped at perimeter to substrate.
- F. Substrate Conditions: pH of 9 or less when substrate wetted with potable water and pHDrion paper applied.

1.6 EXTRA MATERIALS

- A. Provide five percent (5%) extra material for shelf stock of carpeting of each color and type specified. Deliver as requested to owner's storage.

1.7 WARRANTY

- A. Warranties must be the standard, printed warranties on the carpet manufacturer's letterhead. All warranty items to be full term, not pro-rated for the indicated period. All warranties must be issued by the manufacturer as standard published warranties on all types of carpet within this document. If the product fails to perform as warranted when properly installed and maintained according to procedures, the affected area will be repaired or replaced at the expense of the manufacturer. The carpet manufacturer, will provide standard published written performance warranties for the following:
 - 1. **Lifetime warranty against excessive surface wear.** Excessive wear means no more than 10% loss of pile fiber weight measured before and after use as tested under (ASTM D-3936).
 - 2. **Lifetime static protection,** meaning built-in protection below 3.0 kv as tested under AATCC-134.

- B. The carpet manufacturer shall warrant carpet manufactured with **Nexus® tile backing for the useful life of the original installation against product failure from:**
1. Tuft Bind (edge ravel, yarn pulls, zippering)
 2. Delamination
- C. All warranties to be sole source responsibility of the carpet manufacturer. Second source warranties that involve parties other than the carpet manufacturer will not be accepted.
- D. Warranties shall not be written only for this purchase or purchaser. All warranties shall be standard issue nationally of official documents.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Manufacturers:
1. J & J Commercial Carpet
P.O. Box 1287
Dalton, GA. 30722
(800) 241-4586
 2. Subject to compliance with requirements other manufacturers will be reviewed for substitution.
- B. CARPET:
1. Carpet #1: Kinetix Carpet by J&J Commercial

2.2 PERFORMANCE ASSURANCE - GENERAL

The carpet and secondary backing composite when tested shall meet or exceed all flammability requirements for floor coverings as established by the following nationally recognized codes:

- NFPA 11 Life Safety Code to Life in Buildings and Structures Standard Building Code (SBC)
- Uniform Fire Code (UBC)
- *See Section 2.01 for testing requirements*

- A. Flammability Requirements
1. Pill Test / DOC-FF-1-70 (ASTM D-2589) - Requirement: Pass
 2. Flooring Radiant Panel / ASTM E-648 - Requirement: Class 1 (Above .45 w/cm)
 4. Comply with the Carpet and Rug Institute's (CRI) VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Test
- B. Face Fiber Characteristics for all Carpets
1. 100% Bulked Continuous Filament (BCF)
 2. Fiber Type: Encore® Type 6 Nylon, Solutia Ultron® Color Nylon or INVISTA™ Antron Nylon with permanent static protection.
 3. Fiber Performance: As listed in, *Section 1.09, A, 1-4*
 4. Minimum fiber face weight: 26 Oz./ Sq. Yd.
- C. Secondary backing to be Nexus® (Tile Backing)
- D. Adhesive System Characteristics
1. Carpet product to be securely attached to the floor in compliance with Americans with Disabilities Act (ADA), Section 4.5.3.
 2. Product to be installed according to carpet manufacturer's recommendations as

- outlined in the carpet manufactures installation handbook and /or the **Standard for Carpet and Rug Institute's Installation of Commercial Carpet CRI-104.**
3. Floor Adhesive: Adhesive must be approved and supplied by the carpet manufacturer for **all** carpets.
 4. Adhesives must provide a lifetime product performance warranty.
- E. Environmental Impact Characteristics
1. The carpet will, as suggested by the October 1993, Maryland State Dept. of Education Technical Bulletin, pass the Carpet and Rug Institute, Green Label Testing Programs, as a minimum acceptable threshold or "first hurdle" for carpet product selection. "Carpet not meeting the CRI test program should not be considered for use in schools."
 2. Carpet manufacturer and/or fiber producer must be a signatory of the National Carpet Recycling Agreement memorandum of understanding. The MOU is a voluntary agreement to promote reducing the amount of carpet that goes to landfills by specific goals and to foster the eventual sustainability of carpet.
 3. Carpet manufacturer must be a member of the U.S. Green Building Council and participate in the LEED (Leadership in Energy & Environmental Design) Green Building Rating System.

2.3 PERFORMANCE ASSURANCE – CERTIFIED TESTING

- A. Certified test reports shall be submitted by the carpet manufacture, for all performance assurance specifications listed below.
- B. Requirements listed below must be met by all products being submitted for approval.
- C. All submitted test numbers should represent average for standard production goods.
- D. Required Test Reports:
 1. Pill Test / DOC-FF-1-70 (ASTM D-2589) - Requirement: Pass
 2. Flooring Radiant Panel / ASTM E-648 - Requirement: Class I (Above .45 w/cm)
 3. Moisture Penetration Test meeting the British Spill Test Method E. (Part 2) and 10,000 Impact
 4. Roller Chair Caster Test - DIN Test Standard 54324
 5. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Test
 6. Lightfastness: Rating of not less than 3 on International Grey Scale after 40 SFU's. (AATCC Test Method 16E)
 7. Crockfastness: Minimum stain rating on International Grey Scale of not less than 3 wet or dry. (AATCC Test Method 165)
 8. Atmospheric Fading: Burned Gas shall not be less than 3 on International Grey Scale after two cycles on each test. (AATCC Test Method 129 Ozone/AATCC Test Method 23)

PART 3 - EXECUTION

3.1 EXECUTION

- A. Clear away debris and scrape up commentates deposits from concrete surfaces to receive carpet; apply sealer to prevent dusting.
- B. Patch holes and level to a smooth surface. If previous finish chemically stripped, reseal concrete. Seal powdery or porous surfaces with sealer recommended by carpet manufacturer.
 1. Prepare existing surfaces as recommended by carpet manufacturer for compliance

with warranty. Apply primers or bonding agents as may be recommended.

- C. Patch holes and cracks. Grind to level. Remove wax. Seal surface with sealer recommended by carpet manufacturer.
- D. Installation, General: Comply with manufacturer's recommendations installation.
 - 1. Extend carpet under removable flanges and furnishings and into alcoves and closets of each space.
 - 2. Provide cutouts where required, and bind cut edges where not concealed by protective edge guards or overlapping flanges.
 - 3. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.
 - 4. Fit sections of carpet prior to application of adhesive. Trim edges and butt cuts with seaming cement.
 - 5. Apply adhesive uniformly to substrate in accordance with manufacturer's instructions. Butt edges tight to form seams without gaps. Roll entire area lightly to eliminate air pockets and ensure uniform bond.
- E. Remove adhesive from carpet surface with manufacturer's recommended cleaning agent.
- F. Remove and dispose of debris and unusable scraps. Vacuum with commercial machine with face-beater element. Remove spots. Replace carpet where spots cannot be removed. Remove protruding face yarn.
- G. Vacuum carpet.
- H. Protection: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure carpet is not damaged or deteriorated at time of Substantial Completion.

END OF SECTION 09680

SECTION 09900 - PAINTING

PART 1. GENERAL

1.1 PROVISIONS

- A. Requirements of the General Provisions apply to all work under this Section.
- B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards for appearance, quality, and performance and not for the purpose of limiting competition. Specific color selections will be made at the Architect's discretion from among comparable products that fall within the allowances.

1.2 DESCRIPTION

- A. Work covered by this section includes furnishing of and paying for all materials, labor, equipment, licenses, taxes, and other items required for execution and completion of all work under this Section.
- B. The work described in this section of the specifications includes, but is not limited to the following:
 - 1. General and Special Painting of Surfaces, including epoxy painting.
 - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified under other sections.
- C. Surfaces to be Painted:
 - 1. Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not designated in "schedules." Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from standard colors or finishes available.

1.3 RELATED WORK

- A. The following items of related work are specified and included in other sections of these specifications:
 - 1. Caulking and Sealants, Section 07920.
 - 2. Prime coat on shop of factory fabricated steel items.

1.4 SUBMITTALS

- A. Prepare duplicate 12" x 12" samples for each color selection for each type of paint as per schedules for this section.
- B. Provide duplicate 4" x 8" samples of stained wood finish with sand and sealer and urethane varnish. Label and identify each as to location and application. Provide one finished door (where required to be stained) at the jobsite from the approved stain sample prior to finishing all doors. The intent on the door stain is to achieve a uniform finish with little variation across the surface of the door.
- C. One approved sample of each color and finish shall be kept at the job office.
- D. Submit for approval manufacturer's complete descriptive data on all materials to be used.

1.5 DELIVERY

- A. Deliver in manufacturer's original unopened containers, labeled with product description and instructions.

1.6 STORAGE

- A. In addition to requirements of the General Provisions this section shall store flammable materials in tightly closed containers set in well ventilated spaces.

1.7 ENVIRONMENTAL CONDITIONS

- A. Apply exterior paint only when temperature exceeds 50 degrees F. and drying conditions are good and predicted to remain so for at least 24 hours.
- B. Apply interior paint only when inside temperatures exceed 60 degrees F. and will be maintained above that point until paint has dried.
- C. Ventilate interiors during application and drying.
- D. The Painting Contractor shall furnish lighting racks to provide sufficient light for painting operations. In the acceptance or rejection of finished painting, no allowance will be made for lack of proper lighting for painting operations.

1.8 PROTECTION

- A. Protect all finished surfaces by covering or by removing and replacing, in case of small items such as hardware.

PART 2. PRODUCTS

2.1 MATERIALS

- A. Materials shall be manufacturer's best grade of respective types. Indicated along side of a few manufacturers are some examples of "Best Grade". Grade level shall be applicable to all types of paints specified hereinafter.
- B. Acceptable manufacturers and Grade of Paint:
 - 1. Benjamin Moore
 - (a) Latex Eggshell - "Regal Aquavelvet #319".
 - (b) Latex Pearl Sheen - "Regal Aquapearl #310."
 - (c) Latex Semi-Gloss Enamel - "Regal Aquaglo #333."
 - (d) Alkyd Semi-Gloss - "Alkyd Dulamel #207."
 - (e) Two Component System of Epoxy - "Moor-craft" water-borne acrylic epoxy
 - (f) Acrylic Coating "Impervex 309"
 - 2. ICI Dulux - "Spread Satin"
 - (a) Latex Eggshell - "Color Naturals".
 - (b) Latex Satin - "Spread Latex Lo-Lustre".
 - (c) Alkyd Semi-Gloss - "Spread Lustre Semi-Gloss".
 - (d) Water-based catalyzed epoxy.
 - (e) Exterior Paints - Equal to paint specified.
 - (f) Primers for exterior and interior surfaces equal to that specified.
 - (g) Acrylic Coating #6900 Line - "Lifemaster Pro Hi Performance" High Gloss

- 3. Pittsburgh
 - (a) Latex Eggshell - "PPG 6-415".
 - (b) Latex Satin - "PPG Satinhide Latex Lo-Lustre Enamel".
 - (c) Alkyd Semi-Gloss - "PPG 27-150 Midtone Tinting Base".
 - (d) Water-based catalyzed epoxy, "Aqua-pon".
 - (e) Exterior Paints - Equal to paint specified.
 - (f) Primers for exterior and interior surfaces equal to that specified.

- 4. Pratt & Lambert
 - (a) Latex Eggshell - "Accolade".
 - (b) Latex Satin - "Aqua Satin".
 - (c) Alkyd Semi-Gloss - "Cellu-tone Satin".
 - (d) Exterior Paints - Equal to paint specified.
 - (e) Primers for exterior and interior surfaces equal to that specified.

- 5. Sherwin Williams
 - (a) Latex Eggshell - "Pro Mar 200"
 - (b) Latex Semi-Gloss - "Pro Mar 200"
 - (c) Alkyd Semi-Gloss - "Pro Mar 200"
 - (d) Water-based catalyzed epoxy
 - (e) Exterior Paints - Equal to paint specified.
 - (f) Primers for exterior and interior surfaces equal to that specified.

C. Gloss levels for paints required are as follows (ref. National Paint & Coatings Association - NPCA):

<u>Sheen Level</u> <u>Range</u>	<u>Test Method</u>	<u>Gloss</u>
Flat	85 degree meter	Below 15
Eggshell	60 degree meter	5 to 20
Satin	60 degree meter	15 to 35
Semi-Gloss	60 degree meter	30 to 65
Gloss	60 degree meter	Over 65

- D. Acceptable manufacturer for sealing and finishing concrete floor.
 - 1. Hillyard Chemical Company.

2.2 MIXING

- A. Mixing or tinting shall be done at factory.

PART 3. EXECUTION

3.1 CONDITION OF SURFACES

- A. Do not begin work until surfaces to receive paint are dry, firm, sound, clean and free of defects or blemishes which would adversely affect the quality or appearance of the finished work.

3.2 PREPARATION

- A. Clean and sand surfaces to be painted in accordance with paint manufacturer's instructions and as herein specified for each particular substrate condition.
- B. Mask, cover or remove surfaces to be protected from paint.
- C. Clean and remove scale, oil or grease from ferrous metal surfaces.
- D. Mask adjacent wall to prevent overspray. Protect floors and other surfaces with drop clothes.

3.3 APPLICATION

- A. Apply materials to obtain:
 - 1. Smooth uniform appearance.
 - 2. Complete coverage.
 - 3. Match with approved color sample.
 - 4. Work free of runs, sags, and skips.
 - 5. Sharp, clean edges where finishes or colors change.
 - 6. Surfaces free of defect and damage at time of acceptance.
- B. Fill nail holes and cracks after prime coat.
- C. Sand metal, wood, and drywall between coats.
- D. Backprime all new wood surfaces.
- E. The following items (except where noted otherwise) shall be finished to match background adjacent color:
 - 1. All electrical panels in finished rooms.
 - 2. All air grilles, louvers, etc., that are furnished primed or specified to be painted.
 - 3. All unfinished speaker outlet grilles.
 - 4. All visible parts of ductwork and mechanical equipment behind ventilators, grilles or diffusers shall be painted to match adjacent surfaces unless noted otherwise.
 - 5. All columns, conduit, piping, louvers, miscellaneous mechanical items, etc., which are exposed in finished rooms shall be painted to match adjacent surfaces unless noted otherwise.
- F. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
- G. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
- H. Sand lightly between each succeeding enamel or varnish coat.
- I. Paint all closets to match adjacent room finish unless noted otherwise.
- J. Paint all metal trim on interior window lites on doors (sand and prep as necessary if prefinished metal window trim). Paint to match adjacent door frame.

3.4 PAINT QUALITY SCHEDULE

- A. Interior:
 - 1. Gypsum Wallboard (Latex Paint):

- a. Prime: One coat Quick Dry Latex Prime Sealer.
 - b. Finish: Two tinted coats of Latex Enamel Pearl Sheen; color as scheduled.
 2. Ferrous Metal Surfaces: (including door frames)
 - a. Primer: Ironclad Retard-X Rust Inhibitive Alkyd Primer.
 - b. Finish: Two tinted coats Ironclad Alkyd Semi-Gloss Enamel..
 3. Handrails and Railings:
 - a. Primer Paint for Handrails and Railings: Tnemec Series 66 High Build Epoxoline 4-6 dry mil; compatible with finish coats of paint; shop applied.
 - b. High Performance Shop Applied Painted Finish: Tnemec Series 70 Endura-Skid Shield; dry film thickness 1-1/2 to 2-1/2 mil.
 4. Exposed Metal Structure and Deck (Columns, Beams, Joists, etc.)
 - a. Two (2) coats of Waterborne Acrylic Dryfall (B42 Series)-Semi-Gloss Finish
- B. Exterior:
1. Ferrous Metal Surfaces (Rails, Doors, Frames):
 - a. Primer: Ironclad Epoxy Rust Inhibitive Primer.
 - b. Finish: Ironclad Chemical and Water Resistant Epoxy Enamel.
 2. Galvanized Metal (Flashing, Caps, Coving, etc.):
 - a. Primer: Ironclad Galvanized Metal Latex Primer.
 - b. Finish: Ironclad Chemical and Water Resistant Epoxy Enamel.
 3. Asphalt Paving, Parking Stripes and Signage on Paved Area.
 - a. One coat of White Zone Marking Paint.

3.5 PAINT COLOR SCHEDULE

- A. See Finish Schedule for Paint locations.

3.6 CLEAN-UP

- A. Remove masking and protective covering.
- B. Leave factory finish surfaces clean and free of paint.
- C. Remove tools, rubbish, equipment and unused material.

END OF SECTION 09900

SECTION 10100 - VISUAL DISPLAY BOARDS

PART 1 - GENERAL

SCOPE

Furnish and install all markerboards, specialty items and aluminum trim as shown on the drawings and specified herein.

SHOP DRAWINGS

Contractor shall furnish six copies of shop drawings for approval before fabrication and installation.

PART 2 - PRODUCTS

MARKERBOARD

ALL CLASSROOM MARKER BOARDS ARE OWNER PROVIDED/CONTRACTOR INSTALLED:

Equal to Claridge Series I (4'-0" height), Lengths vary: 12' 20', 24' and 28' lengths. Refer to the Series Q1.00 drawings for locations. Assist the Owner by verifying lengths and requirements prior to ordering. Series I, Type A, fabricated from LCS 24 gauge porcelain, Color No. 32, LCS White. All 14' lengths or smaller shall be without joints. All sections over 16' in length shall have one joint in the center. All joints shall have metal cover in color to match boards.

PART 3 - EXECUTION

WORKMANSHIP

All boards and trim shall be installed in accordance with the manufacturer's directions. Coordinate anchorage method with the Owner's Representative. Bid adhesive method of anchorage as recommended by the manufacturer. The contractor shall provide adhesive and accessories required for a complete installation.

FINAL

All boards shall be left true and neatly installed free from blisters and warping.

Boards shall be protected from paint, scratches, and left in perfect condition.

APPROVED MANUFACTURERS

Claridge
Carolina
Green Steel
Nelson Adams
Egan Visual

END OF SECTION 10100

SECTION 10155 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes toilet compartments and screens as follows:

- 1. Type: Stainless Steel/Textured Stainless Steel partitions
- 2. Compartment Style: Overhead braced and floor anchored.
- 3. Screen Style: Floor anchored.

- B. Related Sections include the following:

- 1. Division 10 "Toilet and Bath Accessories" for toilet paper holders, grab bars, purse shelves, and similar accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

- B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.

- 1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

- C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Accurate Partitions Corporation.
2. All American Metal Corp.
3. Bobrick Washroom Equipment, Inc.
4. Capitol Partitions, Inc.
5. General Partitions Mfg. Corp.
6. Global Steel Products Corp.
7. MASCO; Flush-Metal Partition Corp.
8. Mills (Greenguard Inc.)
9. Santana Products, Inc.

2.2 MATERIALS

- A. General: Reference Manufacturer is Bradley/ Mills ; Greenguard Inc. Sentinel Series 400 for overhead braced and Series 500 for floor braced. Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.
- B. Floor Braced Restroom Partitions: Provide and install partitions similar to Bradley/Mills Series 500:
 1. Door Panel and Pilasters consists of two sheet metal faces with 15 year rust warranty.
 2. Panels are 1" thick const. of 22 ga. Stainless steel facing panels with solid particle board or honeycomb core. Provide #4 satin brush finish. Pilasters are 1 ¼" thick 18 ga. SS with 12 ga. Leveling bar.
 3. Provide manufacturer standard heavy duty grade chromed Zamac finished hardware for type of application. Wrap around hinges are through bolted to pilaster and has concealed slide latch. Provide manufacturer standard shoes, brackets; grab bar reinforcing, cutouts.

2.3 FABRICATION

- A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.
 1. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.
- B. Floor-Anchored Screens: Provide pilasters and panels of same construction and finish as toilet compartments. Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Doors: Unless otherwise indicated, 36-inch- wide swing in or out-swinging doors with a minimum 32-inch- wide clear opening for compartments indicated to be handicapped accessible.
 1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
 2. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
 3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.

4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch between pilasters and panels and not more than 1 inch between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.
 1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor Anchored Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING AND CLEANING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.
- B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10155

SECTION 10426 - ARCHITECTURAL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Work covered by this section includes furnishing of and paying for all materials, labor, equipment, licenses, taxes, and other items required for execution and completion of all work under this Section. Refer to herein and also Sheet Q1.00 for Contractor provided and installed signage.
- B. The Owner will provide the room numbering system, do not rely on the construction numbering system to assign room numbers.
- C. Prior to ordering signage, conduct a pre-construction signage conference to coordinate Owner signage preferences, nomenclature, and numbering. Insure proper field and grounds are in place for anchorage of signage.
- D. The work described in this section of the Specifications includes, but is not limited to, the following:
 - 1. Room identification signage (modular plaque)
 - 2. Interior directional signage (modular plaque)
 - 3. Wall mount area identification signage
 - 4. Glass mount room identification signage
 - 5. Exterior raised metal building identification signage
 - 6. Traffic Signage (By Owner)
 - 7. Monumental signage (By Owner)
 - 8. Owner's exterior Signage Package (By Owner)
- E. Refer to Plans for room identification and numbering. Owner numbering designations shall verified with owner. Each room shall receive sign as scheduled in this section. Refer to plans sheets attached as part of this specification for locations of ceiling mounted directional signage, wall and free standing directories.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.
- B. Shop drawings for each type of special type sign required. Show locations, elevations, and sign lettering layout; show anchorages and accessory items. Verify text for signs during shop drawings phase. Owner reserves the right to modify the content of text during this period at no additional cost.
- C. Color Chart: Manufacturer's standard.

- D. Two samples of each different signs type, as selected by the Architect, showing finishes, colors, surface textures, type style and size, and qualities of manufacturer as specified, except for exterior signage. For exterior metal signage, provide single letter typical of actual sample of material and finish to be used.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.
- B. Design Criteria: The Drawings indicate size, profiles, dimensional requirements, and graphics layout of signs and are based on the specific type and model indicated. Signs by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the bidder.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver components correctly packed to prevent damage.
- B. Store in secure areas, out of weather and protected from work of other trades.
- C. Deliver signs for timely installation. All packages shall identify contents.

1.6 WARRANTY

- A. Provide Manufacturer's standard five year limited warranty covering material defects, colorfastness, installation, and other defects identified in the warranty.

PART 2 – PRODUCTS

2.1 GENERAL

Signs and graphic components are to be by a single manufacturer, including necessary mounting options, fittings and fastenings. Signage is based on Appenx Xsite Curved Surface Signage for interior directional, directory, overhead, restroom, misc. room Identification, all room identification adjacent doors, conference rooms. Provide ADA compliant signage throughout the project. Mount at heights required in UDAAG 2010 ed. Final mounting options, text, and signage location are to be determined at the pre fabrication conference.

2.2 SIGN STANDARDS

- A. Typography:
 1. Type style: see attached drawings. Copy shall be a true, clean, accurate reproduction of typeface(s) specified. Upper and lower case or all caps as indicated in Sign Type drawings and Signage Schedule. Letter spacing to be normal and interline spacing shall be set by manufacturer.
 2. Arrows, symbols and logo art: To be provided in style, sizes, colors and spacing as shown in drawings.
 3. Braille: Grade 2, raised .032" from PETG-backed photopolymer material.
 4. Translations: Grade 2 Braille copy is responsibility of the sign manufacturer.
- B. Project Colors and Finishes:
 1. Typography: see drawings
 2. Message Background: see drawings
 3. Metal reveal and decorative inserts: see drawings
- C. Project Finishes:
 1. Finishes are to meet current Federal ADA and any State requirements.
 2. Finish is to be matte, 11 to 19 degrees on a 60 degree glossmeter.

2.3 MANUFACTURER

A. Acceptable manufacturers of specialty signs are as follows:

1. Scotsman
2. Appenx Inc.
3. Best Manufacturing Sign Systems.
4. Andco Industries Corp.
5. ASI Sign Systems, Inc.
6. May-Park Corp.
7. Vista Systems
8. Graphic Specialties

B. Reference Manufacturer: General

1. Other manufacturers must submit their products, for Architects approval, prior to or during bid to be approved as an equal. Substitutions are made under provisions of Section 01600.

C.: INTERIOR ROOM IDENTIFICATION (adjacent each door.)

The Appenx Xsite Curved Surface Signs are referenced. shall consist of a one-piece aluminum module assembly (including end caps), a backer insert and a lens.

1. Module Assembly:
 - a. The Curved Surface Sign shall consist of a minimum .060 thick 6063-T5 extruded aluminum Module, etched and clear or black anodized as the base structure of the sign.
 - b. The Module Assembly shall be capable of accepting message/graphic inserts on one or both sides, depending upon sign style.
 - c. End caps shall be minimum .030" aluminum, permanently attached for single-face signs and .125" painted acrylic for double-face signs.
 - d. The Module Assembly shall be capable of a variety of mounting options including: pressure-sensitive mounting tape, (concealed) screws, magnetic cylinders (neodymium), velcro, pin device for fabric surfaces, system-panel brackets, 90 degree wall projection, freestanding, ceiling grid brackets, ceiling cable and other mounting devices as needed.
 - e. Module shall be capable of accepting an optional horizontal window and slider for vacant/occupied message.
2. Backer Insert:
 - a. The backer insert shall be plastic, metal or laminate, as specified. The backer insert shall provide the background for messages and when removed, provides access to various mounting methods.
 - b. Sign to be capable of decorative inserts (generally the same as the backer insert material) to minimize side (top/bottom) metal reveal.
3. Lens:
 - a. The lens must be a non-glare face surface with an adequate thickness to provide proper tension when installed in the face surface of the sign and removable with a suction cup.
 - b. Curved Surface Lens must be cleanable without use of special chemicals or cleaning solutions.
 - c. Tactile Lens (ADA) – NovAcryl PT, ECR, LP photo polymer sheet. 0.032 inch (0.8mm)

thick moisture resistant, non-glare nylon photo polymer on ultraviolet resistant clear PETG sign base, single piece construction. Laminated photo polymers, added-on characters, and engraved characters are not acceptable. Thickness 0.020, 0.040, 0.060 or 0.118 depending on size of lens for the application.

4. Message/Graphic Inserts:

- a. Message/graphic inserts shall accept various forms of copy, photo embedded copy and graphics and insert into the Module Assembly behind a lens. Front surface graphics are not acceptable.
- b. Message Insert Materials:
 - 1. Graphic/Photo Insert (plastic paper) – 7 mil bright white gloss polyester, moisture resistant printable film
 - 2. Various forms of paper inserts as specified
- c. Interchangeable nature of the sign will allow for changes of graphic components of the installed sign without changing the sign in its entirety.
- d. Multiple lens/inserts to have no separators

5. Graphic Process

- a. 5Vinyl Letters – second surface applied High Performance Cast PVC Vinyl copy.
- b. Tactile lens: .020, .040, .060 or .118 clear PETG with .032 letters/numbers and Braille.
- c. Graphic/Photo Inserts - initially supplied by Appenx.

2.4 Deleted.

2.5 Deleted.

2.6 FREESTANDING DOUBLE SIDED PYLON DIRECTORY

- A. Freestanding Double Sided Pylon Directory: Manufacturer: Appenx Directory . Comprised of 12” high top marquee, 24” high plan graphic and (4) 3” high text panels. Finish clear anodized aluminum.
- B. Provide one sign. To be located in the vicinity of Student Services on the 2nd floor.
- C. Accessories: Provide slim design freestanding steel base, aluminum end caps,

2.7 INTERIOR/ EXTERIOR RAISED LETTERS

- A. Provide ASI LF Series fabricated metal letters, baked on powder-coat finish 8” high, 1-1/2” thick. Mount with aluminum spacers and studs anchored into gypsum panels as per manufacturer’s recommendations. Provide mounting templates.
- B. Locate above counter in Reception Area of Main Building; Letters to say “Welcome, Student Services”.

2.8 Deleted.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Locate sign units where indicated, using mounting methods in compliance with the manufacturer's instructions.

Cleaning and Protection: At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

Provide blocking as required for installation of all units indicated.

END OF SECTION 10426

SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 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. TOILET AND BATH ACCESSORIES ARE PROVIDED BY THE OWNER, RECEIVED AND INSTALLED BY THE CONTRACTOR. Refer to sheet Q1.00 For a complete list of Toilet Accessories to be installed. Refer to Section 10900 Owner Furnished Equipment for additional requirements.
- C. Mirrors are to be provided and installed in toilets are a part of the Contractor's Work:
 - 1. Large Mirrors: 48" x 124"; custom fabricated and installed. Refer to Section 08800 Glazing for mirrors that are a part of this work.
 - 2. Individual mirrors: 30" x 48" custom fabricated and installed. Refer to Section 08800 Glazing for mirrors that are a part of this work.
 - 3. Comply with ADA requirements for mounting heights.

1.2 SUMMARY

- A. Related Sections include the following:
 - 1. Division 10 Section "Toilet Compartments" for compartments and screens.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- B. Samples: For each accessory item to verify design, operation, and finish requirements.
- C. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
- D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

- A. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1.5 COORDINATION

- A. Coordinate accessory locations with Owner's Schedule of Toilet Accessories made available by the Owner's Representative, Scheduled on Sheet Q1.00 and shown on the drawings, and other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Toilet and Bath Accessories:
 - a. A & J Washroom Accessories, Inc.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.
- D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

- A. General: One, maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
- C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446. Comply with Code requirements for location and placement.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10990 OWNER FURNISHED EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

- A Items covered under this section:

1. **Equipment:** Refer to Sheet Q1.00 for a complete **Schedule of Equipment** to be provided, installed, and connected as a complete and fully operable system. The Schedule describes Provider, Installer, Utility systems Connection responsibility, Equipment Type, Description or Name, and other appropriate Special Remarks.
2. This section includes Owner Furnished, Contractor placed and installed, Contractor Connected Items.
3. This section Includes Owner Furnished, Owner installed, Contractor connected and Tested Items.

1.3 RELATED DOCUMENTS

- A The drawings, general provisions, and project manual are hereby made a part of the work of this section.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for accessory item specified.
- B. Shop Drawings: Submit shop drawings indicating location, details of installation, finishes, and other pertinent data.

PART 2 – PRODUCTS

2.1.1 **Owner Furnished, Contractor Installed and connected Items:**

- A. In addition to requirements of the Documents, including but not limited to Drawings and Sections of the Project Manual, the following requirements apply to the Contractor for Work in this section:
 - a. On delivery of the equipment to the site; the Contractor shall uncrate, inspect, accept, and take custody of the assemblies to be installed. From that point on the equipment becomes the responsibility of the Contractor.
 - b. The Contractor shall repair or replace equipment damaged while under Contractor responsibility and care.
 - c. All installation of equipment, accessories, and specialties required for an operable and warrantable system shall comply with the requirements of the Manufacturer of the product. If a conflict in requirements become apparent, contact the Owner's Representative for clarification.
 - d. The Contractor shall include all Owner Furnished Equipment in the Project Schedule and shall monitor and notify the Owner of Submittal, fabrication, delivery and installation of systems and equipment to be installed.
 - e. When the Contractor becomes aware of shipping damaged, or missing components, notify the Owner's Representative and assist the Representative in arranging for quickest possible delivery of the component to minimize delay to the installation schedule.
 - f. Retain and provide all installation instructions, manuals, and as built information to transfer to the Owner's Representative at the time of Final Acceptance of the Equipment.

- g. Final Acceptance of Owner Furnished Contractor Installed Equipment: The Contractor shall include in the Project Schedule and call for a Final Acceptance and commissioning of Equipment. Final Acceptance shall occur on or before the date of Substantial Completion.
- h. The Contractor shall dispose of all crating, boxes, and debris remaining as a part of the Equipment opening, placement, and connecting, and commissioning process.

OWNER PURCHASED, OWNER INSTALLED, CONTRACTOR CONNECTED EQUIPMENT:

- A. In addition to requirements of the Documents, including but not limited to Drawings and Sections of the Project Manual, the following requirements apply to the Contractor for Work in this section:
 - a. The contractor is to provide coordination, agency notifications, testing, anchorage, hook-ups, screws bolts, structural framing, and accessories which are not identified or provided by the Owner as a part of the Equipment but bearing plates, isolators, ventilation, or other items necessary or required for a complete operable assembly.
 - a. Final Acceptance of Owner Furnished/Installed and Contractor Connected Equipment: The Contractor shall include in the Project Schedule and call for a Final Acceptance and commissioning of Equipment. Final Acceptance shall occur on or before the date of Substantial Completion.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install each accessory in compliance with manufacturer's instruction and final shop drawings.
- B. Install at locations and mounting heights indicated or as directed by Architect.

END OF SECTION 10990

SECTION 11132 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Refer to Q1.00 for locations.
- B. Types of projection screens required include:
 - 1. Recessed Front projection screens, manually operated.
 - 2. Surface mounted or suspended projection screens, manually operated.
- C. Wood blocking and trim for recessed screen installation is included in a Division 6 section.

1.3 QUALITY ASSURANCE:

- A. Single Source Responsibility: Obtain each type of projection screen required from a single manufacturer as complete units, including necessary mounting hardware and accessories.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's product data for each type of screen indicated.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Do not deliver projection screens until building is enclosed, other work within spaces where screens will be installed is substantially complete, and installation of screens is ready to take place.
- B. Protect screens from damage during delivery, handling, storage and installation.

PART 2 - PRODUCTS

2.1 FRONT PROJECTION SCREENS, MANUALLY OPERATED:

- A. Viewing Surface of Screen: Comply with the following requirements for type of viewing surface:
- B. Glass beaded viewing surface with minimum gain characteristics complying with FS GG-S-00172D (1) for Type A screen surface.
- C. Mounting: ceiling type.
- D. Edge Treatment: No borders.
- E. Power Operated Screens: Provide manufacturer's standard spring-roller-operated units designed and fabricated for wall or ceiling installation and consisting of case, screen, mounting accessories, and other components necessary for a complete installation.
- F. Screen Case: Fabricated in 1 piece from steel sheet not less than 0.0299 inch with flat back design and vinyl covering or baked-enamel finish. Provide end caps with integral roller brackets and universal mounting brackets, finished to match end caps, for wall or ceiling mounting.
- G. Screen Mounting: Top edge securely anchored to a 3-inch diameter, rigid steel ball bearing roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps and saddle and pull attached to slat by screws.
- H. Size of Viewing Surface: 69" high x 92" wide.
- I. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
- J. Manual Operated Screens for recessed application in classrooms:
 - Da-Lite Advantage Manual with CSR; with UL plenum rated case). High contrast matte white screen. Provide controlled screen return. Bottom of case to have removable access door. Entire case to be white. Provide pull rod.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Mount projection screens in ceiling at locations indicated in compliance with screen manufacturer's instructions.

B. Install front projection screens with screen cases in position and relationship to adjoining work indicated, securely anchored to supporting substrate, and in manner which produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when lowered.

3.2 PROTECTION AND CLEANING:

A. Protect projection screens after installation from damage during construction. If despite such protection damage occurs, remove and replace damaged components or entire unit as required to restore units to their original, undamaged condition.

END OF SECTION

SECTION 20 01 00 - GENERAL PROVISIONS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Architectural Division.
 4. General Conditions.
 5. Supplementary Conditions.

1.02 WORK INCLUDES

- A. The work to be performed under this Division shall include all labor, materials, equipment, and transportation necessary to provide a complete and satisfactory system ready to use. The words "the Contractor" or "this Contractor" refers to the Contractor for the work specified in that Section. This Contractor shall examine all Drawings and all Sections of the Specifications and shall be responsible for ascertaining to what extent other Drawings and Sections affect the work herein specified.
- B. Unless noted on the drawings otherwise, work shall also include:
1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
 2. All utility company charges associated with utility services for the project.
 3. All fees and direct expenses involved in any inspection required for the project.
 4. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
 5. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
 6. All lights, guards, and signs as required by safety regulations applicable to the work.
 7. The removal from the premises, as it accumulates, of all dirt and refuses resulting from the performance of the work.
- C. The work shall include revisions, modifications, and rework of existing work as required for installation of new work, and as required for connections of new work to existing systems, and as required for connections of existing work to new systems.

1.03 CODES, REGULATIONS, AND STANDARDS

- A. All work must be performed in accordance with the requirements of local, county, state and national codes and regulations including the requirements of the following:
1. International Building Code, Latest Edition.
 2. Standard for the Installation of Sprinkler Systems, NFPA 13, Latest Edition.
 3. International Mechanical Code, Latest Edition.
 4. Life Safety Code, N.F.P.A. No. 101.
 5. International Plumbing Code, Latest Edition.
 6. NFPA 17/17A, 72, 72E, 54, and 96.
 7. National Electrical Code.
 8. Occupational Safety and Health Act. of 1970.
 9. For work not specifically listed above, use standards and codes of the National Fire Protection Association.

1.04 ABBREVIATIONS

- A. All equipment, apparatus and systems shall be rated, tested, fabricated and/or installed in accordance with the applicable industry standard mentioned. The following list will serve to clarify abbreviations that appear in other sections of this specification:
- | | |
|--|---|
| 1. AABC-Associated Air Balance Council | 14. IBR-Institute of Boiler and Radiator Mfg. |
| 2. ADC-Air Diffusion Council | 15. IEEE-Institute of Electrical and Electronics Eng. |

- | | |
|---|--|
| 3. AGA-American Gas Association | 16. MCAA-Mechanical Contractors' Association of Am. |
| 4. AMCA-Air Moving and Conditioning Assoc | 17. NEBB-National Environmental Balancing Bureau |
| 5. ANSI-American National Standards Institute | 18. NEMA-National Electrical Manufacturers Assoc. |
| 6. ARI-Air Conditioning and Refrigeration Inst. | 19. NFPA-National Fire Protection Association |
| 7. ASE-Association of Safety Engineers | 20. NSC-National Safety Council |
| 8. ASHRAE-Am. Soc. of Heat, Refrig. & A/C Eng. | 21. NSF-National Sanitation Foundation |
| 9. ASME-American Society of Mechanical Eng | 22. OSHA- Occupational Safety & Health |
| 10. ASTM-American Society for Testing and Matl | 23. SBI-Steel Boiler Institute Industry |
| 11. AWWA-American Water Works Association | 24. SMACNA-Sheet Metal and Air Conditioning Contractors National Association |
| 12. EPA-Environmental Protection Agency | 25. UL-Underwriters Laboratories |
| 13. FS-Federal Specifications Administration | |

1.05 SUBMITTALS

- A. Refer to Architectural Division Section "SUBMITTALS" for requirements for shop drawings and product data.
- B. As soon as possible and within thirty (30) days after the award of the contract and before beginning the fabrication of any material or the installation of any equipment, a complete schedule of the materials and equipment proposed for installation shall be submitted to the Engineer for approval. This schedule shall include manufacturers' names, catalog data, diagrams, drawings and other descriptive data as required or requested by the Engineer.
- C. All items of materials and equipment used for the project shall be submitted.
- D. Submittals shall be assembled in an orderly manner and shall include a title page with space for the Engineer's approval stamp and remarks. It shall also contain a concise listing of all items being submitted. Refer to general conditions of the specifications for format and number of copies required.
- E. Asbestos Free Material/Product: Prior to approval of the material/product to be used, the manufacturer/supplier shall furnish the Engineer with written certification that the material/product contains no asbestos. This certificate is mandatory before approval will be issued. Submittals furnished without the asbestos-free certification will be returned to the Contractor with no action taken until such certification is provided.

1.06 SUBSTITUTION OF EQUIPMENT

- A. Refer to Section 20 01 00, Part 4 - Substitution Request Form. If no form is found, submit by mail, or hand-carried on contractor's or supplier's letterhead. **DO NOT FAX.** Substitutions must be submitted for review and received by the Engineer no later than five (5) working days prior to the bid date to be considered.
- B. All proposed substitutions for specified products on this project (except as listed above) require approval in advance of bidding. Approval will not be granted after award of contract.
- C. It is incumbent on the Contractor to submit technical data that will fully establish the equality of the proposed substitute equipment with that listed and evidence to substantiate the availability of the required repair and maintenance service. Each request for substitution shall be accompanied by the following information for each piece of equipment:
 - 1. Statement indicating that this substituted equipment will not increase the contract cost nor extend the completion date.
 - 2. Manufacturer's name and model number.
 - 3. Catalog cuts, diagrams and other data published by the manufacturer with the particular model identified and the pertinent design data for that model highlighted or underlined for easy reference.
 - 4. Each request for substitution shall also include the following information relating to service maintenance and repair:
 - a. Name, address and telephone number of nearest factory authorized technical representative.
 - b. Name, address and telephone number of firm(s) qualified to perform preventive maintenance, minor or major repairs in the locale of the project.
- D. Name, address and telephone numbers of firm(s) from whom spare parts and major components are available.
 - 1. Building name and address, and the name, address and telephone number of its owner's representative where equipment of the same manufacturer as that requested for substitution has been installed and in operation for two or more years. Two or more such installations shall be listed and the location should be

in the vicinity of the proposed project.

- E. In the event of Engineer's approval of a substitution of equipment, notification will be given by the Engineer (or authorized representative), by the issuance of an addendum to the contract documents incorporating the equipment by name and model number.
- F. The engineer's design as presented in the contract documents is based on the use of equipment from manufacturers as listed in the equipment schedules. Any design changes necessitated by the use of equipment from an alternate manufacturer, even if listed as an "acceptable manufacturer," are the responsibility of the contractor. Any such design changes must be approved by the engineer.
- G. Wherever reasonably possible, all materials and equipment of the same type or class on the project shall be of the same manufacturer's products. A "mixture" of brands for the contractor's convenience will not be permitted. This provision may be waived by the engineer if it is deemed to be in the owner's best interests.

1.07 CONTRACT DRAWINGS

- A. The layout shown on the Contract Drawings is necessarily diagrammatic but shall be followed as closely by actual construction as work will allow. The dimensions of work as shown on the Contract Drawings are not as-built dimensions. No measurements shall be scaled from the drawings and used as definite dimensions for laying out or fitting work in place.
- B. The layout and exact locations of manufactured equipment indicated on the drawings shall be verified with the dimensions of equipment submittals approved by the Engineer.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Follow manufacturer's directions in delivery, storage, protection and handling of all equipment and materials.
- C. Deliver and store equipment and materials to the site in original containers, suitably sheltered from the elements and mechanical injury, but readily accessible for inspection until installed.
- D. Items subject to moisture damage shall be stored in dry, heated spaces.
- E. Ascertain, from examination of architectural drawings, whether any special temporary access openings in the building(s) will be required for admission of apparatus furnished under this Division.
- F. Heavy machinery, equipment and heavy parts thereof shall be brought into building or onto premises by machinery acceptable to Engineer.
- G. Machinery movers shall not rig, tie to, or rest weight upon any building member of any part of building premises or make use of any stairway until specific permission is obtained from Engineer.
- H. Permission to rig to or in any way make use of any part of building premises shall not relieve Installer of responsibility for any damage resulting from, or because of said rigging or use.

1.09 GUARANTEES AND WARRANTIES

- A. Provide two (2) copies of all warranties and guarantees specified in the individual sections of the specifications, or as provided by the various subcontractors and material suppliers. All such documents shall show the name and location of the project and the name of the purchaser.
- B. Contractor shall provide to the Owner a non-prorated guarantee of all materials and workmanship for a period of not less than one (1) year from the date of the Owner's final certificate.
- C. Contractor shall be responsible for enforcing all special or extended guarantees required in individual sections of the specifications that might be provided by various subcontractors or material suppliers.
- D. Acceptance of the work under this Division shall be subject to the conditions that all installed systems, equipment, apparatus, and appliances included in the work shall operate and perform as designed, including code clearances, and as selected with respect to efficiency, capacity and quietness within occupied areas of the building.
- E. Acceptance of the work shall be subject to the conditions that at any time within one year after date of final payment, any defective part of the work resulting from the supply of faulty workmanship or material shall be immediately amended, repaired or replaced as a part of the contract work without cost to the Owner.
- F. This guarantee shall be extended to include the capacity and integrated performance of the component parts of

the various systems in strict accordance with the true intent and purpose of the specification. The contractor shall conduct such tests as herein specified or as may be required by the Engineer to demonstrate the capacity and performance ability of the various systems to maintain specified conditions.

- G. In addition to all above warranties, all refrigeration compressors furnished as part of this project shall have an additional four (4) year parts-only non-pro-rated warranty against failure. This warranty period shall begin at the end of the basic one-year warranty stated above. This level of warranty is a minimum requirement. Refer also to the specific section applicable to each type of compressorized equipment on this project for additional warranty requirements, which may be more restrictive, and if so would govern the warranty to be furnished.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 20 through 26 for rough-in requirements.

3.02 MECHANICAL INSTALLATIONS Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, inform Engineer of conflict.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components.
 - a. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 - b. Extend grease fittings to an accessible location.
11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 23, Section 23 30 00 - "INSPECTION AND ACCESS DOORS."
12. Install systems, materials, and equipment giving priority to systems required to be installed at a specified slope.

3.03 DEFECTIVE WORK AND MATERIAL

- A. All materials or work found to be defective or in non-conformance with the drawings or different from the requirements of the drawings and specifications or damaged through negligence of Contractor or his employees, or through action of fire or weather will be rejected and shall be immediately removed from premises by Contractor and satisfactory materials and work substituted without delay.
- B. All defective or unsatisfactory work shall be corrected immediately upon notification from the Engineer. Previous satisfactory inspection or certificate on record shall not relieve Contractor from his obligation to furnish sound materials and to perform good and satisfactory work.

3.04 COOPERATION AND COORDINATION

- A. Contractor shall confer with other contractors at the site before installing his work to avoid interferences so that maximum head room and clearances may be maintained. In event that interferences develop between work of various contractors, Engineer's decision will be final and no additional compensation will be allowed for changes required.
- B. Particular attention shall be paid to situations where recessed equipment, such as pipes and lights occur, or where the work of several trades occurs together above suspended ceilings, in pipe shafts or in areas where space is limited.
- C. All fixtures, equipment, devices, switches, outlets, pumps, etc., shall be positioned to avoid all interferences with and to assure proper coordination with work of all other trades, cases, partitions, wall, floor and ceiling patterns, architectural features, etc. Engineer will reconcile conflicts where adjustments are warranted.

3.05 CUTTING AND PATCHING

- A. Perform cutting and patching in accordance with Architectural Division Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
 - 1. During cutting and patching operations, protect adjacent installations, structure, furnishings and materials not indicated.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work.
 - 2. Remove and replace defective work.
 - 3. Remove and replace work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed work as specified for testing.
- C. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 1. Patch finished surfaces and building components using new materials specified for the original installation.

3.06 PROTECTION OF EQUIPMENT AND SYSTEMS

- A. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter, and cover all fixtures, equipment and apparatus as required to protect them against dirt, water, chemical or mechanical damage both before and after installation.
- B. Fixtures, equipment or apparatus damaged prior to final acceptance of work shall be restored to original condition or replaced by Installer.
- C. Equipment shall be inherently safe and moving parts shall be covered with guards which meet OSHA requirements.
- D. Provide protective guards for devices such as or similar to thermostats, valves, and switches which are so located as to be readily subject to tampering, accidental damage, or vandalism.
- E. Provide safety railings as required.

PART 4 – SUBSTITUTION REQUEST FORM

MAIL TO: Smith-Goth Engineers, Inc.
(NO FAX ACCEPTED) 3855 S. Jefferson Ave.
Springfield, Missouri 65804

PROJECT:

(THIS FORM MUST BE RECEIVED AT LEAST 5 WORKING DAYS PRIOR TO BID DATE IN ORDER TO BE CONSIDERED)

SECTION: _____ PARAGRAPH: _____ SPECIFIED ITEM: _____ PROPOSED
SUBSTITUTE: _____

Attach a complete description, designation, catalog or model number, Spec Data sheet, and other technical data, including laboratory tests if applicable.

Fill in blanks below:

1. Will substitution affect dimensions indicated on drawing _____

2. Will substitution affect wiring, piping, ductwork, etc. indicated on drawings? _____

3. What affect will substitution have on other trades _____

4. Differences between proposed substitution and specified item? _____

5. If necessary, will the undersigned pay Owner for Engineering costs required to revise the working drawings caused by the substitution? _____

6. Manufacturer's warranties of the specified items and proposed items are: ___ Same ___ Different (explain)___

7. Submitted By:
Firm _____
Address _____ Phone: _____
City/State _____ Fax: _____
Signature: _____ Date: _____

Remarks: _____

Review Comments:
___ Accepted ___ Accepted as noted ___ Not Accepted
___ Received too late By _____ Date _____

Remarks: _____

END OF DOCUMENT 20 01 00

SECTION 20 02 00 - CONTRACT CLOSE-OUT & COMMISSIONING**PART 1 - GENERAL**

1.01 MAINTENANCE MANUAL AND OPERATING INSTRUCTIONS (20 01 00)

- A. Upon completion of the work, Contractors shall provide the Engineer with two copies of maintenance manuals or one electronic copy of all equipment furnished and installed under his work.
- B. Manuals shall be in substantial 3-ring binders or in electronic format (pdf) with project name and number inscribed on face and hinged back. Manuals shall include roster of all training session attendees. The manuals shall, however, first be approved by the Engineer. The manuals shall include, but not be limited to manufacturer's lubricating and operating instructions and parts list and serial numbers for all operating machinery, including drive information, and motor horsepower, amperage, and voltage readings on all phases, valve chart, sequence of operation, index following the order listed in the specifications, warranties in the name of the Installation, and a list of manufacturers, service firms and subcontractor's names and telephone numbers.
- C. Training attendance rosters for each training session shall be included in manuals. Roster will identify training subject, date, attendees name, job title, and telephone number.
- D. All switches, controls, and safety devices shall be clearly and permanently marked with embossed or printed plates as to purpose and as to operation and shall be tested in the presence of the Owner designated representative to ensure that he understands their function and purpose.
- E. Upon completion of the work, Contractors shall put the systems into service. Contractors shall be entirely responsible for the equipment during all testing operations including the lubricating and turning on and off of such apparatus.

1.02 PROJECT RECORD AND CLOSEOUT DOCUMENTS

- A. Refer to Architectural Division Section "RECORD DOCUMENTS" for red lining of all documents during construction to reflect "as-built" conditions.
- B. In addition to the requirements specified in Architectural Division, indicate the following installed conditions:
 - 1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
 - 2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Section 20 03 00- "MATERIAL AND METHODS". Indicate actual inverts and horizontal locations of underground piping.
 - 3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 5. Contract Modifications, actual equipment and materials installed.

1.03 CLEANING EQUIPMENT AND SYSTEMS (20 01 00)

- A. All equipment, piping systems and duct systems shall be thoroughly cleaned internally and externally before being placed in service.
- B. The Contractor is charged with the responsibility for maintaining all systems and equipment clean and free of foreign matter during the processes of assembly and erection.
- C. Pipe strainers and air filters shall be cleaned and serviced immediately prior to final inspection.
- D. When flushing systems, all control, thermal and other elements subject to blocking by foreign matter shall be removed.
- E. When piping systems are flushed with fluids other than that normally contained, the Contractor shall take adequate precautions to insure that the normal contents of the piping will not be contaminated when placed in service.

1.04 FIRESTOPPING (20 03 00)

- A. Where ducts and/or pipes penetrate fire-rated ceilings, walls, floors, and any other fire rated assembly the cavity shall be sealed with intumescent material capable of expanding 5 to 10 times when exposed to temperatures of 250°F. It shall be ICBO, BOCA, and SBCCI (NRB 243) approved ratings per ASTM E-814 (U.L. 1479). Acceptable materials: DOW-CORNING 3-6548 silicone RTV foam or 3-M fire barrier caulk, or 3-M fire barrier 2001 silicone RTV foams.
- B. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining surfaces.
- C. Identification
 - 1. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
 - 2. The words: "Warning-Through-Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage"

1.05 TESTING REPORTS (20 04 00)

- A. Submit three (3) copies or one electronic copy of all testing reports to the Engineer.

1.06 PIPING SYSTEM IDENTIFICATION (20 04 00)

- A. General: Install pipe markers on each system indicated to receive identification, and include arrows to show normal direction of flow.
- B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - 1. Near each valve and control device.
 - 2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - 3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - 4. At access doors, manholes and similar access points which permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
 - 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

1.07 COMMISSIONING SPRINKLER SYSTEMS

- A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:
 - 1. Verify that specialty valves, trim, fittings, controls, and accessories have been installed correctly and operate correctly.
 - 2. Verify that specified tests of piping are complete.
 - 3. Check that damaged sprinklers and sprinklers with paint or coating not specified have been replaced with new, correct type of sprinkler.
 - 4. Check that sprinkler are correct type have correct finish and temperature ratings, and have guards where required for applications.
 - 5. Check that potable water supplies have correct type of backflow preventer.
 - 6. Check that hose valves and fire department connections have threads compatible with local fire department equipment and have correct pressure settings.

7. Fill wet-pipe sprinkler systems with water.
8. Adjust operating controls and pressure settings.
9. Coordinate the fire alarm systems tests. Operate systems as required.

1.08 DISINFECTION OF DOMESTIC WATER SYSTEMS (22 00 00)

- A. Refer to "Certification Form –Disinfection of Domestic Water Systems" at the end of Section 20 02 00.
- B. General:
 1. Before being placed in service and after testing is completed, all potable water piping shall be chlorinated as specified herein, in accordance with AWWA Standard C651 or AWWA C652 and as required by the local Health Department codes.
 2. The lines and fixtures shall be flushed thoroughly after chlorination to remove all foreign matter.
 3. Injection shall start only when all fixtures are connected and ready for operation.
- C. A service cock or riser ($\frac{3}{4}$ " to at least 1- $\frac{1}{4}$ ") shall be provided by the Contractor and located at the point of connection to water service. The disinfecting agent shall be injected into and through the system from this cock or riser only.
- D. New or repaired potable water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be the procedure described in this section. This requirement shall apply to "on-site" or "in-plant" fabrication of a system or to a modular portion of a system.
 1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
 2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.
 3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
 4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.
 5. If satisfactory, all fixtures shall be flushed until residual or orthotolidine tests are not greater than the water supply.
 6. Contractor shall furnish Engineer or his authorized representative with sterilization report indicating potable water to be safe from contamination.

1.09 FLUSHING WATER PIPING (22 00 00)

- A. After the piping has been chlorinated, each run of pipe shall be thoroughly flushed out so as to remove all foreign matter from the lines. Flushing will ordinarily be done by opening drain valves along the lines.
- B. Sufficient flushing water shall be introduced into the mains to produce a velocity of not less than 4 ft. per second, and this flow rate shall be continued until the discharge is clean and clear and does not show evidences of silt or foreign matter when a sample is visually inspected.

1.10 FIELD QUALITY CONTROL OF GAS PIPING SYSTEMS (23 11 00)

- A. Inspect, test, and purge gas systems according to NFPA 54, Part 4 "Gas Piping Inspection, Testing, and Purging" and local gas utility requirements as applicable.
- B. Repair leaks and defects with new materials, and retest system until satisfactory results are obtained.
- C. Report test results promptly and in writing to the Engineer.
- D. Verify capacities and pressure ratings of gas meters, regulators, valves, and specialties.
- E. Verify correct pressure settings for pressure regulators.
- F. Verify that specified piping tests are complete.

1.11 COMMISSIONING REFRIGERANT PIPING (23 23 00)

- A. Charge system using the following procedure:

1. Install core in filter dryer after leak test but before evacuation.
 2. Evacuate refrigerant system with vacuum pump; until temperature of 35 deg F is indicated on vacuum dehydration indicator.
 3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
 4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
 5. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.
 6. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.
- B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.

1.12 CLEANING AND ADJUSTING OF HVAC EQUIPMENT

- A. Cleaning: Upon completion of installation, inspect units and associated components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
- B. Adjusting: Make control and other adjustments for optimum heating, cooling and/or efficiency.

1.13 STARTUP OF CONDENSING UNITS (23 81 26)

- A. Start-up condensing unit, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- B. Train Owner's personnel on start-up and shut-down procedures, troubleshooting procedures, servicing, and preventative maintenance schedule and procedures. Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals specified in Architectural Division.

1.14 HVAC SYSTEM TRAINING (25 50 00)

- A. The contractor shall conduct a training session for the Owner's operating and maintenance personnel to familiarize them with all HVAC equipment and HVAC control system. This session shall be held after the system is fully operational. The session shall be video taped, and the tape given to the owner at the conclusion of the session.

1.15 CONTROL EQUIPMENT LABELING (25 50 00)

- A. Labels shall be installed wherever necessary to clarify functions of components and facilitate adjustment and servicing. Labels shall be required on, but not limited to the following:
1. Control panels.
 2. Automatic damper motors.
 3. Freeze protection stats.
 4. Air-handling units and their starters.

1.16 FINAL ADJUSTMENT OF CONTROLS (25 50 00)

- A. After completion of the installation, adjust all thermostats, control valves, motors and other equipment provided under this contract and place them in complete operating condition subject to approval of Engineer.
- B. Visit the project after approximately 6 months operation to review adjustments as needed.

1.17 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS (23 05 93)

- A. HVAC systems shall be tested and balanced by an independent agency retained by the General Contractor, or by the contractor, as called for in Section 23 05 93. Independent testing and balancing may be omitted only if specifically allowed by Section 23 05 93.
- B. The HVAC Contractor shall put all heating, ventilating and air conditioning systems and equipment into operation and shall continue the operation of same during each working day of testing and balancing and shall place the automatic temperature control system in satisfactory operation before TAB agency shall begin work.
- C. The Contractor shall make all necessary corrections within 48 hours upon notification of TAB agency of the

deficiencies requiring adjustment, (piece-meal correction is not acceptable) and within 10 working days for items that require replacement or installation.

- D. Prior to the final acceptance of the HVAC system by the Engineer, the Contractor shall coordinate with the TAB agency to schedule this work in cooperation with other trades involved and comply with the completion date of the project.

1.18 CERTIFICATION FORM – DISINFECTION OF DOMESTIC WATER SYSTEMS

Date: _____ **Job Name:** _____

Disinfection Contractor: _____

Address: _____

City, State: _____

Phone No: _____

Date Disinfection/Chlorination was performed: _____

I, the Disinfection Contractor, certify with my signature below that I (or my authorized representative) performed a flushing, disinfection/chlorination and testing procedure on the new and/or repaired domestic (potable) water system at the “Job Name” noted above. The procedure is outlined in Specification Section 20 02 00 “Contract Closeout & Commissioning” under “Disinfection of Domestic Water Systems” and in the International Plumbing Code, latest Edition.

Contractor/Representative: _____

Signature: _____ **Date:** _____

END SECTION 20 02 00

SECTION 20 03 00 - MATERIALS AND METHODS**PART 1 - GENERAL**

1.01 WORK INCLUDES

- A. Provide all material as specified in this Section.

1.02 SUBMITTALS

- A. Submit shop drawings in accordance with Section 20 01 00 for the following devices:
- | | |
|-------------------------------|--------------------------------------|
| 1. Pipe and fittings. | 2. Strainers. |
| 3. Pipe hangers and supports. | 4. Pressure gauges and thermometers. |
| 5. Valves. | 6. Starters. |
| 7. Firestopping Material(s). | 8. Vibration isolation devices. |
- B. Submit certificates of compliance for pipe, fittings and valves specified under this section.

1.03 PROTECTION

- A. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter, and cover all fixtures, equipment and apparatus as required to protect them against dirt, water, chemical or mechanical damage both before and after installation.
- B. Fixtures, equipment or apparatus damaged prior to final acceptance of work shall be restored to original condition or replaced by Installer.
- C. Equipment shall be inherently safe and moving parts shall be covered with guards which meet OSHA requirements.
- D. Provide protective guards for devices such as or similar to thermostats, valves, and switches which are so located as to be readily subject to tampering, accidental damage, or vandalism.
- E. Provide safety railings as required.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Hangers, Supports, and Inserts (Insulated or non-insulated piping)
- | | |
|-------------------|-----------------|
| 1. Elcen - 12X. | 2. Anvil - #65. |
| 3. B-Line B-3100. | |
- B. Industrial Type Thermometers
- | | |
|-----------------------------|------------------------------|
| 1. Palmer Instruments, Inc. | 2. Weksler Instruments Corp. |
| 3. Terice Co. | 4. Miljoco |
- C. Gauges
- | | |
|--------------|------------------|
| 1. Ashcroft. | 2. Marshalltown. |
| 3. Marsh. | 4. Miljoco |
- D. Piping vibration isolators
- | | |
|----------------|----------|
| 1. Metraflex | 2. Mason |
| 3. Amber-Booth | |
- E. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 FLUES, VENTS, AND CHIMNEYS

- A. Vent connectors from individual equipment
1. May be single-wall vent pipe unless otherwise called out on plans. Single-wall vent connectors must be totally exposed in the mechanical room, and may not penetrate any wall, ceiling, or chase. Vent connectors for water heaters (where permitted by the recommendations of the manufacturer) shall be 22 gauge

- galvanized, minimum. All joints shall be made with proper fittings. Cut-in "Taps" will not be permitted.
2. Vent connectors shall be the same size as the appliance outlet, unless shown larger on the drawings. They shall pitch upward at $\frac{1}{4}$ " per foot minimum. Length shall not exceed that allowed by the applicable mechanical code. Two vent connectors shall not be combined before connecting to the vent or chimney.
- B. Positive Pressure Vent – Stainless Steel:
1. This applies to boiler flue piping.
 2. The gas vent system shall be Selkirk SAF-T vent AL29-4C stainless steel or approved equal.
 - a. Single wall shall be EZ seal with a factory built in silicone seal.
 - b. Double wall shall be CI plus with a 1" air gap between the AL29-4C stainless steel liner and a 430 stainless steel outer jacket and utilize a silicone seal.
 3. Listed to UL 1738.
 4. For single wall applications clearance of 2" is required to combustibles. When clearance to combustibles can not be maintained, double wall pipe shall be used. All installations shall match existing work.

2.03 HVAC CONDENSATE PIPING

- A. HVAC Condensate Piping:
1. Horizontal condensate lines longer than 5 feet (such as in ceiling spaces) shall be 1 $\frac{1}{2}$ " Schedule 40 PVC DWV. Connections to units shall be $\frac{3}{4}$ ", equipped with a trap.
 2. Condensate lines which pass through return air plenum ceiling spaces shall be 1" type "L" hard-drawn copper in lieu of PVC as stated above.
 3. Vertical condensate lines which are not downstream of larger piping shall be $\frac{3}{4}$ " PVC, Schedule 40, DWV.
 4. Condensate lines which penetrate outside walls and spill to grade shall be hard-drawn copper tube, Type "L".
 5. Exterior condensate lines shall be PVC Schedule 40, electrical conduit, ultra-violet resistant. Size per plans.

2.04 PIPING MATERIALS

- A. All piping and fittings shall be manufactured in the United States. Each length of pipe and each fitting shall be marked with the manufacturer's name or trademark and the specification code to which it conforms.

2.05 PIPES AND TUBES

- A. Pipe, tubing, fittings and joining materials are specified within each specific individual sections.

2.06 VALVES

- A. Refer to Section 20 05 00 "Valves" for globe, ball, butterfly, and check valves.

2.07 PIPE SPECIALTIES

- A. Unions in copper pipe 2 in. and smaller shall be Mueller, Anaconda or Chase Brass, brass solder joint unions constructed for 150 psi working pressure.
- B. Unions 2- $\frac{1}{2}$ in. in size and larger shall be companion flanges. (ANSI B16.1). Flanged unions shall be Van Stone, Grinnell or Crane Lap flanges over welding nipples welded into pipelines.
- C. Dielectric unions suitable for dielectric service shall be provided at pipe connections between steel or cast iron piping and copper tubing.
- D. Vibration isolation devices shall be molded rubber type, unless otherwise specified on drawings. Provisions for limiting deflection shall be incorporated.

2.08 HANGERS, SUPPORTS AND INSERTS

- A. Hangers and supports shall conform to the recommendations of Standard Practice SP.58 of the Manufacturers' Standardization Society of the Valve and Fitting Industry.
- B. All hangers for insulated piping shall be oversized to allow the insulation to run through the hanger uninterrupted. Insulation shall be protected from crushing by sheet metal shields.
- C. Where several pipes occur at the same elevation, trapeze type hangers may be used. Trapeze hangers shall be made of 2 inch x 2 inch structural steel angles with legs down. All copper tubing supports shall be copper plated or insulated from dissimilar materials.
- D. Hanger rods shall conform to the following:

<u>Pipe Size</u>	<u>Rod Diameter</u>
Up to 2"	3/8"
2-1/2 " to 5"	1/2"
6" to 10"	5/8"

Trapeze hanger rods shall be of sufficient size to carry weight of trapeze channel, piping and contents, insulation supports and an additional 200 lb. load.

- E. Wire or perforated strap iron hangers, expansion anchors, and power actuated fasteners will not be permitted.

2.09 SLEEVES

- A. Provide pipe sleeves for all penetrations of piping through walls.
- B. Floor sleeves (for floors above grade) shall be standard weight galvanized steel pipe or PVC pipe with bottom set flush with surface below and top extending 1" above finished floor (3" in mechanical equipment rooms). Seal around pipe and pipe sleeve with fire resistant waterproofing caulking materials.
- C. Wall sleeves for exterior foundation walls shall be cast iron, standard weight galvanized steel or PVC schedule 40 fabricated sleeves flush with wall inside and outside. Caulk with oakum and lead wool or otherwise adequately waterproof opening between pipe and sleeve.
- D. Wall sleeves for masonry walls shall be standard weight galvanized steel pipe flush with all surfaces.
- E. Wall sleeves for interior partitions and ceilings shall be 20 gauge galvanized steel with lock joints.
- F. Sleeves for piping that is to be insulated shall be large enough to allow insulation to pass through the sleeve. Refer to Section 22 07 19 "Insulation" for specific thicknesses of insulation.

2.10 FIRESTOPPING

- A. Where ducts and/or pipes penetrate fire-rated ceilings, walls, floors and any other fire rated assembly the cavity shall be sealed with intumescent material capable of expanding 5 to 10 times when exposed to temperatures of 250° F. It shall be ICBO, BOCA, and SBCCI (NRB 243) approved ratings per ASTM E-814 (U.L. 1479). Acceptable materials: DOW-CORNING 3-6548 silicone RTV foam or 3-M fire barrier caulk, or 3-M fire barrier 2001 silicone RTV foams.

2.11 ESCUTCHEONS

- A. Provide set-screw chrome plated escutcheons (not friction-dependent) on all exposed pipe or pipe insulation passing through or into finished walls, partitions, ceiling and floors. Escutcheons at insulated pipes shall be large enough to encircle insulation without penetrating vapor barrier or jacket.

2.12 INDUSTRIAL TYPE THERMOMETERS

- A. Industrial type thermometers shall be the adjustable angle type with 9" case and a minimum stem length of 2 1/3" insertion in piping.
- B. Casing shall be cast aluminum with double strength glass, white face with dark graduations.
- C. Element shall be a red reading mercury tube and brass stem.
- D. Provide separable brass sockets for all thermometers in piping systems. Provide extension sockets when installed in insulated piping.

2.13 PRESSURE GAUGES

- A. Ranges of gauges shall be two times indicated operating pressure or 5 PSIG above relief valve setting. Verify ranges on shop drawings.
- B. Gauges shall be 4- 1/2" dial gauges encased in an aluminum diecast housing with a threaded access cover and glass crystal. The gauge body shall be water and dust tight with back flange and 3/8" npt. connection.
- C. Movements shall be rotary geared stainless steel with Grade "A" phosphor bronze Bourdon tube rated from 30" vacuum to 1000 PSIG maximum. Accuracy shall be within 1% of the scale range.

2.14 MOTORS

- A. For each item of equipment requiring electric drive, provide a motor having starting and running characteristics consistent with torque and speed requirements of the driven machinery.
- B. Motors shall be of ample size to operate continuously at their proper load and speed without causing noise, vibration or temperature rise in excess of their rating.
- C. Motors shall be of sufficient size as to be non-overloading throughout entire capacity range of the driven equipment.
- D. Motors 1/2 HP and smaller shall be designed for 120 volts, single phase, 60 hertz operation, and be capacitor start and run, 40 C. continuous rise, open-drip-proof type and shall be equipped with permanently lubricated sealed bearing.
- E. Motors 3/4 HP and larger shall be suitable for voltage as specified under Division 26; 3 phase, 60 hertz operation, shall be squirrel cage type NEMA design B, low current in-rush and normal starting torque, quiet operating, 40 C. continuous rise and shall be equipped with permanently lubricated sealed bearing, unless otherwise specified.
- F. Efficiency: All motors as available shall to be "Energy Efficient", provide motors with higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, test method B.

2.15 STARTERS

- A. Each piece of equipment requiring a motor starter for operation shall be furnished with a starter. Starters shall be integral to the equipment and shall be factory-installed whenever such integrally-mounted starters are available from the specified equipment manufacturer.
- B. Separately mounted motor starters are permitted where the specified equipment is not normally available with integrally-mounted starters. Such separately-mounted starters shall be furnished along with the equipment (by the equipment supplier or the contractor) unless the necessary starters are specifically called out for the application in question as electrical equipment on the electrical drawings for the project or in the Division 26 specifications.
- C. Variable frequency drives for HVAC or other mechanical equipment will be furnished under Mechanical Division, whether or not they are an integral part of the equipment they control, unless they are specifically called out as electrical equipment on the electrical drawings for the project or in the Division 26 specifications for the particular application.
- D. Where possible, provide motor starters of the same manufacturer as specified under Division 26.
- E. Motor starter overload heater coil sizes shall be determined by motor nameplate.
- F. Motor starter control circuits and devices shall be 120 volt, 60 hertz regardless of power circuit voltage serving motor. Provide a 120 volt control circuit transformer where one is needed.
- G. Contactors shall be similar to starters.
- H. Automatically started equipment shall have starter with hand-off-auto switch; manually operated electrical equipment shall have start-stop buttons, unless otherwise indicated on drawings.
- I. Coordinate with work under Division 26 to insure proper motor starting and circuit protection is provided in compliance with code requirements.
- J. Assume responsibility for compliance with code requirements where groups of motors require circuit protection as per NEC., Article 430.
- K. Provide auxiliary contacts where required for interlocking, intermittent starting, pilot control, remote control, motor shut-down and safety features.

2.16 AUXILIARY DEVICES

- A. Each trade providing equipment requiring automatic control or remote control shall provide all proper pilot devices to perform the particular duty specified for the driven equipment. In no case shall safety devices be bypassed.
- B. Automatic control and signal devices such as for temperature control, pump control, fire alarm, etc., all wiring for same, and all interlock wiring, shall be provided by the Contractor furnishing said equipment, unless specifically indicated otherwise under other Sections of Mechanical Division.
- C. Coordinate automatic control work and the work of Division 26.

2.17 CONDUIT AND WIRING

- A. Wiring systems provided under Mechanical Division shall be as specified in Division 26.
- B. All electrical terminals shall be labeled.
- C. Provide wiring diagrams inside each cabinet.
- D. Conduit shall comply with all requirements of Division 26.
- E. Final connections to equipment shall be flexible.

2.18 BELT AND COUPLING GUARDS

- A. Guards shall be provided for all belt-driven units and at chains, gears, couplings, keys, projecting set screws, and other rotating or moving parts. Belt guards shall be made to enclose both pulleys and belts on exposed sides, and shall be constructed of galvanized steel top, bottom, and sides with expanded metal front. Entire assembly shall be rigidly supported with all necessary supplementary steel, and shall be provided for greasing, oiling, adjusting, checking of equipment, etc. Provide coupling guards on direct connected units. Guards shall be readily accessible and designed for easy removal for service and shall comply with Underwriters' Safety Requirements.

PART 3 - EXECUTION

3.01 FLUE, VENT, AND CHIMNEY INSTALLATIONS

- A. Install in accordance with all requirements of the applicable mechanical code.
- B. Comply with applicable requirements of NFPA 54, fuel gas code, latest edition.
- C. Any joint in the system which cannot be assembled using factory-fabricated fittings shall be welded gas-tight.

3.02 PIPE AND FITTINGS APPLICATIONS

- A. Use pipe, tube, fittings, and joining methods as specified within each specific individual section.

3.03 JOINTING OF PIPING

- A. Threads shall be full and clean cut, and ends of pipe shall be reamed. When screwed joints are assembled, the male thread shall be thoroughly coated with appropriate thread compound to serve as a joint sealer and as a prime coat of paint for the exposed threads. (Teflon tape may be used at contractor's option.) Care shall be taken to keep all other foreign matter from entering the interior of the piping. Each section of pipe and all fittings shall be carefully inspected for dirt, grease, or other foreign matter on the inside and where necessary they shall be properly cleaned before assembly.
- B. Soldered or brazed joints made with fittings having pre-inserted rings of solder or brazing alloy shall have the tube and fittings cleaned bright and fluxed. The joint shall be heated sufficiently to make a tight connection. Tubes and fittings without such rings, shall be cleaned bright, fluxed and heated until the solder is drawn into the joint by capillarity and the connection is tight. Flux shall be water soluble binder flux. In potable water systems, the use of solder and flux exceeding 0.2 percent lead content is prohibited.

3.04 EXPANSION AND CONTRACTION

- A. Provisions shall be made for expansion and contraction in all piping. Piping shall be installed in a manner such that joints will not develop leaks. All expansion shall be taken up by swing-connections, and the Contractor shall be responsible for the installation of these connections whether or not they are shown on the Drawings with specific means for relieving expansion and contraction. Slip-type expansion joints shall not be used. Particular care must be exercised at branches on underground piping to allow free movement at branch connection to main.
- B. Nested Expansion Loops: Provide flexible expansion loops of bronze hose and braid with copper sweat ends at locations noted on drawings. Size to equal line size. Flexible loops shall be designed to impart no thrust loads on the anchors. The loop shall consist of two flexible sections of hose and braid, two 90E elbows and a 180E return. Loops shall be installed in a neutral, pre-compressed or pre-extended condition as required for application. Install and guide per manufacturer's recommendations. Flexible loops to be Metraloops as manufactured by the Metraflex Company of Chicago, Illinois.

3.05 PIPING VIBRATION ISOLATORS

- A. Vibration isolators shall be installed at all points where piping connects to equipment that may cause vibration due to moving parts. See also requirements for specific locations shown on drawings or in schematic diagrams.

3.06 INSTALLATION OF PIPING

- A. Piping shall be installed on long continuous lengths, with a minimum number of joints. Joints, where necessary shall be carefully made to insure against leakage.
- B. All piping shall be firmly supported using hangers, brackets and braces to prevent sagging and/or lateral movement. All hangers, brackets, and other supports shall be securely fastened to the construction as may be required and in a manner acceptable to the Engineer. All piping shall be installed to maintain maximum head room. Nothing shall be suspended from the roof deck.
- C. Arrangement of all piping shall be as shown on plans. It is especially necessary that all mains be installed with view to accessibility in case of repair and location of pipe lines and spacing between same shall be so made that there will be no conflict between pipe lines by the several trades.
- D. Contractor shall give careful consideration to clearances and locations of lines and type of fittings used to obtain these clearances. Provide maximum headroom in all cases. Piping shall be installed parallel to building walls and at a height so as not to obstruct any portion of a window, light fixture, doorway, pipe tunnel or passageway. Ascertain from the drawings heights of all suspended ceilings, size of all pipe shafts in which piping is to be concealed, and location and size of structural members in and adjacent to all pipe shafts.
- E. Where interferences develop in the field, Contractor shall offset or reroute piping as required to clear such interferences. In all cases consult architectural drawings for exact location of pipe spaces, ceiling heights, or other architectural details before installing piping.
- F. Under no circumstances shall the size of piping shown on the drawings be changed without written approval of the Engineer.
- G. Provide eccentric reducers where required for proper drainage or venting of horizontal pipe lines. Reducing fittings shall be used for all changes of pipe size and bushings shall not, under any circumstances, be used.
- H. Unions or flanges are to be installed on the equipment side of all valves in pipe connections from mains to equipment, to enable equipment to be drained and disconnected without necessitating the draining of mains.
- I. Valves must be arranged for easy access and be within easy reach and the piping shall be arranged to accomplish this.
- J. All piping installed outdoors without an insulation system shall be painted to prevent rusting. Color shall be selected to match adjacent finishes. See painting specifications for painting requirements.

3.07 WELDING

- A. When welding is to be performed, precautionary measures must be taken to prevent fire. Provide water barrels and fire buckets or 2-½ gal, water pump extinguisher, in close proximity to welding work. All piping shall be shop-fabricated to the greatest extent practicable.

- B. Welded joints shall be made by the oxy-acetylene or electric process in accordance with Code for Pressure Piping ANSI B31.1.
- C. Filler metal for the oxy-acetylene welding process shall conform to the American Society for Testing and Materials Specification for Iron and Steel Gas-Welding Rods, ASTM Designation A251-46T, Classification GA60. Filler metals for the metallic arc welding process shall conform to the American Society for Testing and Materials Specification for Mild Steel Arc-Welding Electrodes, ASTM Designation A233-58T. Classification of electrodes shall be one of the following: E6010, E6015, E7016, E7018.
- D. Welds shall be of the single vee butt type for which the pipe shall be mill leveled to 45 degrees to within 1/16 in. of the inside wall surface.
- E. The abutting ends of the joints shall be separated before welding to permit complete fusion to the bottom without overlapping, tacked in two or more points to maintain alignment, and welded. All welding shall be continuous around the pipe.
- F. Welds shall be of sound weld metal, thoroughly fused into the ends of the pipe and to the bottom of the vee, and shall be built up in excess of the pipe wall to give a reinforcement of one-quarter (1/4) the pipe wall thickness and in such a manner that one weld metal will present a gradual increase in thickness from the surface of the pipe to the center of the weld. The minimum width of the weld shall be 2-1/2 times the pipe wall thickness.
- G. The fillet welds for flanges of fittings shall be fused into the pipe and plate for a minimum distance of 1-1/2 times the pipe wall thickness and shall be built up to present a minimum throat thickness of depth of weld of 1-1/4 times the pipe wall thickness.
- H. Welding ells shall be used at all turns in welded pipe lines; no mitered ells will be approved.
- I. Where welded mains are 3 in. in size or larger and branches are 2 in. in size and smaller, branch connections shall be made up with "Thread-O-Lets" as manufactured by Bonney Forge, Tube Turns or Tube Line, Inc. Welding tees or Weld-O-Lets shall be used for all other branch connection, unless specifically agreed otherwise with the Engineer for a specific case.
- J. Welded piping shall be subject to a hydrostatic test of not less than 100 psi, or of 1-1/2 times the working pressure whichever is the greater at which pressure all welded joints shall be hammered with a three pound hammer, the blows being struck with a sufficient force to jar the pipe and joint, but not so hard as to injure the piping. All welds must pass this test without showing leaks or any defects.
- K. Welding shall be done with good quality modern welding equipment by competent operators, and in a thorough, first class, workmanlike manner. Preparation, fabrication welding and installation shall be in accordance with ANSI B31.3 - 1962.
- L. The Contractor shall be required to furnish proof of the competency of each welding operator, and shall at the request of the Engineer, have all or any of such welding operators pass a standard qualification test such as A.S.M.E., A.W.S. or Hartford Insurance Company procedure and tests.

3.08 HANGERS, SUPPORTS AND INSERTS

- A. Provide all hangers, supports, bracing, inserts, beams, anchors, guides, sleeves and miscellaneous steel for the proper support, alignment, expansion and contraction of piping and equipment.
- B. Hanger supports shall be securely fastened to structural members by approved beam clamps and clips, concrete inserts, anchors, or other appropriate methods agreed upon with the Engineer.
- C. Maximum spacing of hangers and supports for steel and copper piping shall be as follows:

<u>Pipe Size</u>	<u>Spacing</u>
1/2" thru 1-1/4"	Not over 6'-0"
1-1/2" thru 3"	Not over 10'-0"
4" and 6" (steel only)	Not over 12'-0"
- D. Maximum spacing of hanger and support for CPVC piping shall be as follows:

<u>Pipe Size</u>	<u>Spacing</u>
1" or smaller	Not over 4'-0"
1- 1/4" or 1-1/2"	Not over 5'-6"
2" and Larger	Not over 6'-0"
- E. Maximum spacing of hanger and support for PVC Schedules 40 or 80 piping shall be as follows:

<u>Pipe Size</u>	<u>Spacing</u>
1" or smaller	Not over 2'-6"
1- 1/4" thru 2"	Not over 3'-0"

2-1/2" and Larger

Not over 4'-0"

- F. Cast iron or bell and spigot piping shall be supported at every joint.
- G. Additional hangers and supports shall be provided to minimize undesirable stress on valve bodies, other fittings and equipment.
- H. Provide all supplemental angles, channels and plates of adequate sizes where bracing or supports are required for piping between structural members.

3.09 OPENINGS IN CONSTRUCTION

- A. All cutting or provision of openings that may be necessary for the installation of this Work shall be done by the Contractor, and all patching and repairing shall be done by workmen competent in the trade required. The Contractor shall be responsible for arranging the work so that minimum cutting will be required.

3.10 CONCRETE EQUIPMENT PADS

- A. The Contractor shall supply all concrete pads and machine bases required for his equipment unless noted otherwise.
- B. All floor-mounted mechanical equipment shall be set on appropriately sized concrete housekeeping pads unless their installation details (on the drawings) show these pads to be omitted.
- C. Concrete supplied for machine bases shall be as specified under CONCRETE. Pads for fans shall be dowelled to slab floors with one (1) ¼ in. steel rod per sq. ft. of pad. Dowels shall project a minimum of 2 in. into the slab and 2 in. into the pad. All other pads shall be of 4 inch high, 2 inch high, or other dimensions as indicated. Pads shall have chamfered edges and equipment anchors.

3.11 VALVES

- A. Install ball valves with the stem above body in accessible position.
- B. The necessary valves shall be installed within the systems to provide the following:
 - 1. Required shut-off.
 - 2. Flow control service.
 - 3. Isolation for inspection.
 - 4. Maintenance repair of each piece of equipment.
 - 5. Maintenance and repair of each fixture.
 - 6. Each main and branch service loop.
- C. Each valve shall be installed so that it is easily accessible for operation, visual inspection and preventative maintenance.

3.12 MOTORS

- A. Unattached electric motors (motors furnished loose with equipment) shall be set by the contractor. Motors shall be leveled and aligned on bases and foundation pads in strict accordance with the manufacturer's instructions and their recommended tolerances before any electrical connections are made. After all connections have been made and just prior to placing each motor in operation, levels and alignment shall be re-checked. All necessary adjustments shall be made to assure that the thrust is balanced, that shaft rotates freely when turned by hand. All final connections to motor shall be made under Division 26.

3.13 THERMOMETERS AND GAUGES

- A. Install thermometers and gauges in piping systems and duct systems as shown. Thermometers and gauges for each major equipment item shall be readily readable from one position while standing on floor or through the ceiling access panel. Gauges shall not be installed until systems are cleaned.

3.14 CLEANING THE PIPING SYSTEMS

- A. Before pipe covering is applied and final tests are made, flush the water piping systems thoroughly to remove

grit, sand, oil, etc., for as long a time as is required to thoroughly clean apparatus and piping. Make the required temporary connections for this purpose.

- B. Care must be taken not to get dirt, grease, etc., upon the floors or walls. Any damage done shall be promptly repaired at contractor's expense.
- C. After the period of these operations, any defects or damages that may have developed in equipment and apparatus as a result of the cleaning process or the operation of the system shall be made good, and the apparatus put in first class working order.

END OF SECTION 20 03 00

SECTION 20 04 00 - TESTING PIPING SYSTEMS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
 - 1. Drawings.
 - 2. General Provisions of the Contract.
 - 3. Architectural Division.
 - 4. General Conditions.
 - 5. Supplementary Conditions.

1.02 WORK INCLUDES

- A. Provide pressure tests on soil, waste, storm drain and vent piping systems.
- B. Provide pressure tests on domestic cold and hot water piping systems.
- C. Provide pressure tests on HVAC chill and hot water piping system.
- D. Provide pressure tests on all wet pipe fire sprinkler systems.
- E. Provide water fill tests on HVAC cooling tower piping.
- F. Provide pressure tests and leak tests on gas piping system.

1.03 RELATED WORK

- A. Architectural Division - "GENERAL REQUIREMENTS".
- B. Section 20 03 00 - "MATERIALS AND METHODS".
- C. Section 22 00 00 - "PLUMBING".
- B. Section 22 07 19 - "PIPING INSULATION".
- E. Section 23 23 00 - "REFRIGERANT PIPING".
- F. Section 33 00 00 - "SITE PIPING".

1.04 SUBMITTALS

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".

1.05 QUALITY ASSURANCE

- A. Notify Engineer three days prior to the tests, who will in turn notify other interested parties.
- B. Piping systems where required, shall be pressure tested for leaks in accordance with the Code for Pressure Piping, ANSI B31.1.0, and as specified herein.
- C. All tests shall be performed and all piping defects shall be corrected prior to insulating, inaccessible concealing or backfilling. Leaks shall be repaired, all repaired piping shall be retested. All defective pipe, materials and workmanship shall be removed and replaced and tests shall be repeated until systems are proven entirely tight.
- D. The tests shall not be performed until after cleaning the piping systems.
- E. The tests shall be reported using the form provided in this section of the specifications.

PART 2 - PRODUCTS

2.01 TESTING MATERIALS

- A. All materials, pumps, compressors and equipment required for testing shall be provided by the Contractor installing the piping system.
- B. Where water is used in hydrostatic testing, only potable water shall be used.
- C. For testing waste and vent piping, provide inflatable test plugs (long or short) as required.

PART 3 - EXECUTION

3.01 TESTING OF PIPING SYSTEM - GENERAL

- A. Devices or equipment, or parts thereof regulators, gauges, thermometers, etc., which may be damaged by test pressures shall be removed or protected during tests.
- B. Fabricated piping shall not be connected to equipment until testing has been completed. Before applying test pressure, provide restraining devices as required to prevent distortion of piping system during testing.
- C. Welding and screwed joints and other potential leak sources of the systems to be hydrostatically tested shall be painted with a powdered blue chalk and water mixture and allow to dry before testing begins.
- D. All joints in the piping systems shall be inspected during the test period. All defective joints shall be removed, repaired and replaced.
- E. Where air is used for pressure testing, the air pressure shall be gradually applied. All leak sources shall be checked for leaks by applying a coating of soap suds to the source.
- F. After tests have been completed and piping systems proven tight, piping and equipment shall be tested for complete drainage through unions, caps, plugs, faucets or hose valves at low points. If piping and equipment do not drain properly, piping and equipment shall be regraded and drain points added until system can be completely drained. Systems shall be left dry in freezing weather.

3.02 SOIL, WASTE, STORM DRAIN AND VENT PIPING SYSTEM

- A. Stacks, vent piping, and underfloor sewers of all kinds shall be tested by capping outlets 5'-0" outside building wall, capping all connections, providing a 10'-0" high tight pipe extension and filling with water to top of extension.
- B. Water shall remain in each system for at least 2 hours without dropping more than 1". Leaks shall be repaired and tests repeated until system is proven watertight. System may be tested in sections, but every joint between sections must be tested. Install inflatable test plugs in waste piping cleanouts and floor drains as needed for testing.
- C. Test pressure shall be maintained in waste and vent piping during construction of adjacent masonry walls. If piping is damaged and test pressure is lost during construction, the necessary repairs shall be made and the test pressure restored before proceeding with construction.

3.03 DOMESTIC COLD AND HOT WATER PIPING SYSTEMS

- A. Domestic cold and hot water piping shall be hydrostatically tested to a pressure of 100 psig registered at ground floor level.
- B. Testing shall be considered complete when systems hold the test pressure for a minimum period of one hour without variation in pressure except that which is due to changes in temperature.

3.04 WET PIPE SPRINKLER SYSTEMS

- A. All fire sprinkler piping shall be tested in accordance with NFPA No. 13, Chapter 10, System Acceptance.
- B. Per NFPA No. 13, Chapter 8, the required minimum hydrostatic test pressure is 200 psi. Test pressure is to be maintained without loss for 2 hours.
- C. See NFPA No. 13, Chapter 8 for test exceptions and interim air test requirements.

3.05 GAS SYSTEM TESTS

Pressure Test (Part 1)

- A. All gas piping shall be "pressure tested" in accordance with NFPA No. 54 (the minimum test).
- B. Pressure for "pressure test" shall be 20 psi and the minimum test duration shall be two (2) hours.
- C. The "pressure test" medium shall be air or inert gas. Oxygen shall never be used.

Leak Test (Part 2)

- A. The total gas piping and equipment system shall be “Leak Tested” in accordance with NFPA No. 54, whenever the gas system is initially placed into service.
- B. The “Leak Test” medium shall be the fuel gas at its normal supply pressure, except as noted under Paragraph “G” below.
- C. The fuel gas shall be applied to the total gas system and the system shall be leak tested per NFPA-54, Appendix D, “Suggested Method for Checking for Leakage”.
- D. Before Turning on Gas:
 - 1. Before gas is introduced into a system of new gas piping, the entire system shall be inspected to determine that there are no open fittings or ends and that all manual valves at outlets on equipment are closed and all unused valves at outlets are closed and plugged or capped.
- E. Test for Leakage:
 - 1. Immediately after the gas is turned on into a new system the piping system shall be tested for leakage. If leakage is indicated, the gas supply shall be shut off until the necessary repairs have been made.
- F. Placing Equipment in Operation:
 - 1. Gas utilization equipment shall NOT be placed in operation until after the piping system has been tested in accordance with Paragraph “E” and purged in accordance with Paragraph “G”.
- G. Placing in Operation:
 - 1. When piping full of air is placed in operation, the air in the piping shall be displaced with fuel gas, provided the piping does NOT exceed the length shown in NFPA-54, Table 4.3.2. The air can be safely displaced with fuel gas provided that a moderately rapid and continuous flow of fuel gas is introduced at one end of the line and air is vented out at the other end. The fuel gas flow shall be continued without interruption until the vented gas is free of air. The point of discharge shall not be left unattended during purging. The vent shall then be closed.
 - 2. If the piping exceeds the lengths shown in NFPA-54, Tables 4.3.1 and 4.3.2, the air in the piping shall be displaced with an inert gas, and the inert gas shall then be displaced with fuel gas.
 - 3. If the piping is smaller than listed in Tables 4.3.1 and 4.3.2 then the air in the piping system shall be displaced with fuel gas.

NFPA-54, Table 4.3.1 and Table 4.3.2
Length of Piping Requiring Purging Before Being Placed in Operation or Servicing or for Modification

Nominal Pipe Size (in.)	Minimum Length of Piping Requiring Purging (ft.)
2 ½	50
3	30
4	15
6	10
8 or larger	Any length

- H. Discharge of Purged Gases:
 - 1. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are sources of ignition unless precautions are taken to perform this operation in a safe manner by ventilation of the space, control of purging rate, and elimination of all hazardous conditions.
- I. Placing Equipment in Operation:
 - 1. After the piping has been placed in operation, all equipment shall be purged and then placed in operation, as necessary.
- J. Contractor shall complete the attached “Piping Test Form”, at the end of this Section, as proof of completion.

3.06 PIPING TEST FORM

Date: _____

Project: _____

Contractor: _____

See specifications for proper procedure including time, pressure, and test medium.

Medium: Water
 Air
 Other: _____

Time Start: _____

Time Stop: _____

Time Elapsed: _____ hr. _____ min.

Pressure Start: _____ psi

Pressure Stop: _____ psi

Pressure Drop: _____ psi

Waste Pipe

Level Start: _____

Level Stop: _____

Level Drop: _____

Type of Piping System:

- | | |
|--|---|
| <input type="checkbox"/> Sanitary Waste | <input type="checkbox"/> Gas |
| <input type="checkbox"/> Domestic Water | <input type="checkbox"/> Medical Gas |
| <input type="checkbox"/> Heating/Cooling Water | <input type="checkbox"/> Compressed Air |
| <input type="checkbox"/> Refrigeration | |

Name (Print): _____

Signature: _____

END OF SECTION 20 04 00

SECTION 20 05 00 - VALVES**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Architectural Division.
 4. General Conditions.
 5. Supplementary Conditions.

1.02 WORK INCLUDES

- A. This Section includes general duty valves common to most mechanical piping systems.
1. Special purpose valves are specified in individual piping system specifications.

1.03 RELATED WORK

- A. Section 20 01 00 - "GENERAL PROVISIONS".
B. Section 20 03 00 - "MATERIALS AND METHODS".

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 20 01 00 as follows:
1. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Comply with the requirements specified in Architectural Division Section "MATERIALS AND EQUIPMENT," under "Source Limitations."
B. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Valves:
- | | | |
|----------------------|-------------|---------------|
| 1. Bell and Gossett | 5. Grinnell | 9. Stockham |
| 2. Conbraco (Apollo) | 6. Jomar | 10. Victaulic |
| 3. Crane | 7. Keystone | 11. Watts |
| 4. Flowdesign | 8. Nibco | |
- B. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 VALVE FEATURES - GENERAL

- A. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.
B. Sizes: Same size as upstream pipe, unless otherwise indicated.
C. Operators: Provide the following special operator features:
1. Handwheels, fastened to valve stem, for valves other than quarter turn.

2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 10 plug valves.
- D. **Extended Stems:** Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- E. **End Connections:** As indicated in the valve specifications.
1. **Threads:** Comply with ANSI B1.20.1.
 2. **Flanges:** Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
 3. **Solder-Joint:** Comply with ANSI B16.18.
 - a. **Caution:** Where soldered end connections are used, use solder having a melting point below 840 deg F for globe, and check valves; below 421 deg F for ball valves.

2.03 GATE VALVES

- A. Do Not Use Gate Valves in Building Piping Systems.

2.04 BALL VALVES

- A. Ball Valves, 2 Inches and Smaller: Rated for 150 psi saturated steam pressure, 400 psi WOG pressure; two-piece construction; with bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle.
- B. Provide extended stems for ball valves installed on all piping which will be below ambient temperature during normal operating (to allow insulation).

2.05 BUTTERFLY VALVES

- A. Butterfly Valves, 2-½-Inch and Larger: MSS SP-67, Lug-style; rated at 200 psi; cast-iron body conforming to ASTM A 126, Class B. Provide valves with field replaceable EPDM sleeve, nickel-plated ductile iron disc (except aluminum bronze disc for valves installed in condenser water piping), stainless steel stem, and EPDM O-ring stem seals. Provide lever operators with locks for sizes 2 through 6 inches and gear operators with position indicator for sizes 8 through 24 inches.

2.06 CHECK VALVES

- A. Swing Check Valves: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.
- B. Wafer Check Valves: Class 250, cast-iron body; with replaceable bronze seat, and non-slam design lapped and balanced twin bronze flappers and stainless steel trim and torsion spring. Provide valves designed to open and close at approximately one foot differential pressure.

PART 3 - EXECUTION

3.01 VALVE ENDS SELECTION

- A. Select valves with the following ends or types of pipe/tube connections:
1. Copper Tube Size, 2-Inch and Smaller: Solder ends.
 2. Steel Pipe Sizes, 2-Inch and Smaller: threaded or grooved end.
 3. Steel Pipe Sizes 2-½ Inch and Larger: grooved end or flanged.

3.02 VALVE INSTALLATIONS

- A. General Application: Use ball and butterfly valves for shut-off duty; globe, and butterfly for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.
 - 1. Locate valves for easy access and provide separate support where necessary.
 - 2. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.
 - 3. Install valves in horizontal piping with stem at or above the center of the pipe.
 - 4. Install valves in a position to allow full stem movement.
- B. Installation of Check Valves: Install for proper direction of flow as follows:
 - 1. Swing Check Valves: Horizontal position with hinge pin level.
 - 2. Wafer Check Valves: Horizontal or vertical position, between flanges.

3.03 FIELD QUALITY CONTROL

- A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.04 ADJUSTING AND CLEANING

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

END OF SECTION 20 05 00

SECTION 20 06 00 - MECHANICAL IDENTIFICATION**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
 - 1. Drawings.
 - 2. General Provisions of the Contract.
 - 3. Solicitation Documents.
 - 4. General Conditions.
 - 5. Supplementary Conditions.
 - 6. Architectural Division.

1.02 WORK INCLUDES

- A. Provide identification of all systems and equipment installed under Mechanical Division.

1.03 RELATED WORK

- A. Architectural Division - "GENERAL REQUIREMENTS".
- B. Section 20 01 00 - "GENERAL PROVISIONS".

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service.
- B. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Allen Systems, Inc.
- B. Brady (W.H.) Co.; Signmark Div.
- C. Industrial Safety Supply Co., Inc.
- D. Seton Name Plate Corp.
- E. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 PLASTIC PIPE MARKERS

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded,

pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.

- C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 2. Adhesive lap joint in pipe marker overlap.

2.03 UNDERGROUND-TYPE PLASTIC LINE MARKERS

- A. General: Manufacturer's standard permanent, bright-colored, continuous-printed detectable tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.
1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

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, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".

3.03 UNDERGROUND PIPING IDENTIFICATION

- A. General: During back-filling/top-soiling of underground gas piping, install continuous underground-type detectable type line marker, located directly over buried line at 6" to 8" below finished grade.

END OF SECTION 20 06 00

SECTION 20 07 00 - EXISTING SYSTEMS AND EQUIPMENT**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Solicitation Documents.
 4. General Conditions.
 5. Supplementary Conditions.
 6. Architectural Division.

1.02 WORK INCLUDES

- A. Contractor shall perform all work on all existing systems and equipment that require expansion, relocation, modification, and/or repairs as per the drawings and/or specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 RELOCATED OR SERVICED EQUIPMENT

- A. From the time that the equipment is disconnected, or taken out of service, until the time that the equipment is started up and commissioned, the equipment shall be the responsibility of the contractor. Any damage occurring during the disconnecting, storing, relocating, re-installing or start-up shall be repaired by the contractor so that the condition of the equipment will be at least as good as when disconnected in the judgment of the engineer.
- B. Contractor is responsible to ascertain and submit in writing to the engineer operating condition of existing equipment prior to being taken out of service. If contractor fails to provide a report on the condition and operation of the existing equipment, then it will be assumed that the existing equipment was fully functional, and operating correctly at its full intended capacity at the time of being taken out of service.
- C. Accessory items necessary for the proper operation of existing relocated equipment shall be relocated and re-installed per manufacturer's recommendations. The contractor shall verify proper operation of such accessories before disconnecting the equipment. Notify engineer of any accessory items which need to be replaced before relocation the equipment.

3.02 EXPANDED SYSTEMS:

- A. Any existing system which is expanded as a part of this project (HVAC duct, hydronic piping, plumbing etc.) shall be expanded per the sizes and/or flows indicated in the contract documents.
- B. Materials used for the expansion of any existing system shall meet the specifications in Section 20 03 00, and shall also meet the requirements of local codes.
- C. Commissioning of any expanded system means the commissioning of the entire system, both the existing and new components.
- D. The contractor shall add glycol to any existing hydronic system requiring glycol to bring the concentration of the entire system up to that concentration specified on the drawings.
- E. The contractor shall install refrigerant and oil as required by any affected existing refrigeration system.

3.03 OWNER FURNISHED EQUIPMENT REQUIRING PLUMBING CONNECTIONS

- A. Provide rough-ins and final connections to all Owner furnished equipment including shut off valves, piping, traps, etc. necessary to connect up equipment after it has be installed in place.
- B. Install all faucets, sinks drains, tailpieces, overflows, traps, etc. furnished loose with all Owner furnished

equipment.

- C. All exposed piping readily visible for Owner furnished equipment shall be chrome plated red brass pipe and fittings. Braces for support of exposed piping shall be chrome plated.
- D. Pending installation of Owner furnished equipment, all service lines shall be suitably capped, plugged and protected. All water lines shall be valved.
- E. Furnish vacuum breakers, pressure regulators solenoid valves, traps, piping, etc. as required for installation of equipment.

END OF SECTION 20 07 00

SECTION 20 08 00 - TEMPORARY FACILITIES AND CONTROLS**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
1. Temporary utilities include, but are not limited to, the following:
 - a. Sewers and drainage.
 - b. Water service and distribution.
 - c. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - d. Heating and cooling facilities.
 - e. Ventilation.

PART 2 - PRODUCTS

2.01 EQUIPMENT

- A. Heating Equipment: Unless Architect, Engineer and Owner authorizes use of permanent heating and/or cooling system, provide vented, self-contained, electric, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY FACILITY INSTALLATION

- A. No temporary utilities are required. Existing systems may be used.
- B. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- C. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

END OF SECTION 20 08 00

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
 - 1. Drawings.
 - 2. General Conditions.
 - 3. General Provisions of the Contract.
 - 4. Supplementary Conditions.
 - 5. Solicitation Documents.
 - 6. Architectural Division.
 - 8. Section 28 31 00 - "Fire Alarm Systems"
 - 7. Section 33 00 00 - "Site Piping"

1.02 WORK INCLUDES

- A. The wet-pipe sprinkler systems for buildings and structures.
- B. Sprinkler cabinet with spare sprinklers and sprinkler wrenches.
- C. Fees, permits and licenses; see Section 20 01 00, 1.02 "Work Includes".

1.03 SUBMITTALS

- A. Product data for fire protection system components. Include the following:
 - 1. Backflow preventers.
 - 2. Valves, fittings and all types of pipe to be used.
 - 3. Specialty valves, accessories, and devices.
 - 4. Alarm devices. Include electrical data.
 - 5. Fire department connections. Include type of fire department connection; number, size, type, and arrangement of inlets; size and direction of outlet; and finish.
 - 6. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other data.
- B. Sprinkler system shop drawings identified as "working plans," and prepared according to NFPA 13. Submit required number of sets to authority having jurisdiction for review, comment, and approval. Include system hydraulic calculations. "Working Plans" and calculations shall be sealed/signed by a registered professional engineer, licensed in the project's state. Do not submit unsealed/signed shop drawings or hydraulic calculations, as they will be rejected.
- C. Test reports and certificates as described in NFPA 13. Include "Contractor's Material & Test Certificate for Aboveground Piping" and "Contractor's Material & Test Certificate for Underground Piping."
- D. Maintenance data for each type of fire protection specialty specified, for inclusion in Operating and Maintenance Manual specified in Section 20 02 00 -"CONTRACT CLOSE-OUT & COMMISSIONING."
- E. Two (2) copies of NFPA 25 "Standard for Inspection, Testing and Maintenance of Water Based Fire Protection Systems." Deliver to Owner's maintenance personnel.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL Fire Protection Equipment Directory and FM Approval Guide and that conform to other requirements indicated.
- B. Listing and Labeling: Equipment, specialties, and accessories that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in "National Electrical Code," Article 100.
- C. Comply with requirements of authority having jurisdiction for submittals, approvals, materials, hose threads, installation, inspections, and testing.
- D. Licensed Engineer: Submit "Working Plans" and hydraulic calculations. Include seal and signature of registered engineer licensed in jurisdiction where Project is located, certifying compliance with specifications and

applicable codes.

- E. Installer's Qualifications: Firms qualified to install and alter fire protection piping, equipment, specialties, and accessories, and repair and service equipment. A qualified firm is one that is experienced (minimum of 5 previous projects similar in size and scope to this Project) in such work, familiar with precautions required, and in compliance with the requirements of the authority having jurisdiction. Submit evidence of qualifications to the Engineer upon request. Refer to Architectural Division Section "REFERENCE STANDARDS AND DEFINITIONS" for definition of "Installer."
- F. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following as applicable:
1. NFPA 13 "Standard for the Installation of Sprinkler Systems."
 2. NFPA 26 "Recommended Practice for the Supervision of Valves Controlling Water Supplies for Fire Protection."
 3. NFPA 70 "National Electrical Code."

1.05 DEFINITIONS

- A. Pipe sizes used in this Section are nominal pipe size (NPS) specified in inches. Tube sizes are standard tube size specified in inches.
- B. Working plans as used in this Section refer to documents (including drawings and calculations) prepared pursuant to requirements in NFPA 13 for obtaining approval of authority having jurisdiction and for fabrication and installation of the sprinkler systems.
- C. Other definitions for fire protection systems are included in referenced NFPA standards.

1.06 SYSTEM DESCRIPTION

- A. Wet-Pipe Sprinkler System: System with automatic sprinklers attached to piping system containing water and connected to water supply so that water discharges immediately from sprinklers when they are opened by fire.
- B. Sprinkler System Protection Limits: All spaces within areas indicated. Include closets, toilet and locker room areas, each landing of each stair, and special applications areas.

1.07 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design and obtain approval from authority having jurisdiction for fire protection systems specified.
- B. Minimum Pipe Sizes: Not smaller than sizes indicated for connection to water supply piping and system riser.
- C. Conduct fire hydrant flow tests as required to obtain hydraulic data needed to prepare design for hydraulically calculated systems.
- D. Hydraulically design sprinkler systems according to:
1. Sprinkler System Occupancy Hazard Classifications as indicated by Drawings or as required by code.
 2. Minimum Density Requirements for Automatic Sprinkler System Hydraulic Design: As follows:
 - a. Light Hazard - .10 GPM/sq. ft. over 1500 sq. ft.
 - b. Ordinary Hazard, Group 1 Occupancy: 0.15 GPM/sq. ft. over 1500 sq. ft.
- E. Where sprinklers are of the quick-response type, the areas of operation used in the hydraulic calculations may be reduced by the proper application of NFPA 13 paragraph 11.2.3.2.3.
- F. Components and Installation: Capable of producing piping systems with the following minimum working pressure ratings except where indicated otherwise.
1. Sprinkler Systems: 175 psig (1200 kPa).

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Backflow Preventers:
- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Ames Co., Inc. 3. Cla-Val Co. 5. Conbraco Industries, Inc. | <ol style="list-style-type: none"> 2. Hersey Products, Inc., Grinnell Corp. 4. Watts Regulator Co. 6. Wilkins Regulator Div., Zurn Industries, Inc. |
|---|--|

- 7. Febco.
- B. Fire Department Connections:
 - 1. Badger-Powhatan, Figgie International Co.
 - 2. Guardian Fire Equipment, Inc.
 - 3. Croker Div., Fire-End and Croker Corp.
 - 4. Potter-Roemer Div., Smith Industries, Inc.
 - 5. Elkhart Brass Mfg. Co., Inc.
 - 6. Reliable Automatic Sprinkler Co., Inc.
 - 7. Firematic Sprinkler Devices, Inc.
 - 8. Sierra Fire Equipment Co.
 - 9. Gem Sprinkler Co. Div., Grinnell Corp.
- C. Fire Protection Service Gate and Check Valves:
 - 1. Gem Sprinkler Co. Div., Grinnell Corp.
 - 2. Stockham Valves and Fittings, Inc.
 - 3. Kennedy Valve Div., McWane, Inc.
 - 4. Victaulic Company of America.
 - 5. Nibco, Inc.
- D. Grooved Couplings for AWWA Ductile-Iron Piping:
 - 1. Gustin-Bacon Div., Tyler Pipe Subsid., Tyler Corp.
 - 2. Victaulic Company of America.
- E. Grooved Couplings for Steel Piping:
 - 1. Grinnell Supply Sales Co., Grinnell Corp.
 - 2. Stockham Valves and Fittings, Inc.
 - 3. Gustin-Bacon Div., Tyler Pipe Subsid., Tyler Corp.
 - 4. Victaulic Company of America.
 - 5. Sprink-Line by Sprink, Inc.
- F. Indicator Posts and Indicator Post Gate Valves:
 - 1. Clow Valve Co. Div., McWane, Inc.
 - 2. Nibco, Inc.
 - 3. Gem Sprinkler Co. Div., Grinnell Corp.
 - 4. Stockham Valves and Fittings, Inc.
 - 5. Kennedy Valve Div., McWane, Inc.
 - 6. Waterous Co.
- G. Specialty Valves and Electric Alarm Bells:
 - 1. ASCOA Fire Systems, Figgie International Co.
 - 2. Globe Fire Sprinkler Corp.
 - 3. Central Sprinkler Corp.
 - 4. Reliable Automatic Sprinkler Co., Inc.
 - 5. Firematic Sprinkler Devices, Inc.
 - 6. Star Sprinkler Corp.
 - 7. Gem Sprinkler Co. Div., Grinnell Corp.
 - 8. Viking Corp.
- H. Sprinklers:
 - 1. ASCOA Fire Systems, Figgie International Co.
 - 2. Globe Fire Sprinkler Corp.
 - 3. Central Sprinkler Corp.
 - 4. Reliable Automatic Sprinkler Co., Inc.
 - 5. Firematic Sprinkler Devices, Inc.
 - 6. Star Sprinkler Corp.
 - 7. Gem Sprinkler Co. Div., Grinnell Corp.
 - 8. Viking Corp.
- I. Waterflow Indicators and Supervisory Switches:
 - 1. Gamewell Co.
 - 2. System Sensor Div., Pittway Corp.
 - 3. Gem Sprinkler Co. Div., Grinnell Corp.
 - 4. Victaulic Company of America.
 - 5. Potter Electric Signal Co.
 - 6. Watts Regulator Co.
 - 7. Reliable Automatic Sprinkler Co., Inc.
- J. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 PIPES AND TUBES

- A. Refer to Part 3 Article "Sprinkler and Standpipe System Piping Applications" and for identification of systems where pipe and fitting materials specified below are used.
- B. Ductile-Iron Pipe: ANSI/AWWA C151/A21.51, ductile-iron barrel with iron-alloy threaded flanges, 150-psig minimum working pressure rating, and AWWA C104 cement-mortar lining.
 - 1. Option: Pipe may be AWWA pattern, cut-grooved for grooved-coupling joints.
- C. Steel Pipe: ASTM A 53, Schedule 40 in sizes 6 inches (150 mm) and smaller and Schedule 30 in sizes 8 inches (200 mm) and larger, black and galvanized, plain and threaded ends, for welded, threaded, cut-groove, and rolled-groove joints.
- D. Steel Pipe: ASTM A 135, Schedule 10 through 5-inch (125 mm) sizes and NFPA 13 specified wall thickness for 6-inch (150 mm) through 10-inch (250 mm) sizes, with plain ends, black and galvanized, for rolled-groove and welded joints.
- E. Steel Pipe: ASTM A 135, threadable lightwall, black and galvanized, for threaded joints.
- F. Steel Pipe: ASTM A 795, black and galvanized, for joints listed and for use with fittings for plain-end steel pipe.
 - 1. Type: Lightweight pipe, Schedule 10, for rolled- groove and welding joints.

2.03 SPECIALLY LISTED PIPE AND TUBE

- A. CPVC Pipe: ASTM F 442, non-metallic special listed chlorinated polyvinyl chloride (CPVC). All CPVC pipe shall have an orange/copper color and be marked continuously along its length to properly identify that the type of pipe is listed for fire sprinkler service.

2.04 PIPE AND TUBE FITTINGS

- A. Ductile-Iron and Gray-Iron Flanged Fittings: AWWA C110, 250-psig (1725 kPa) minimum pressure rating, with AWWA C104 cement-mortar lining.
- B. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150 or 300, standard pattern, with threads according to ASME B1.20.1.
- C. Cast Iron Threaded Fittings: ASME B16.4, Class 125 or 250, standard pattern, with threads according to ASME B1.20.1.
- D. Grooved-End Fittings for Ductile-Iron Pipe: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron, AWWA pipe-size, designed to accept AWWA C606 grooved couplings. Include cement lining or Food and Drug Administration (FDA)-approved interior coating.
- E. Steel Fittings: ASTM A 234/A 234M, seamless or welded; ASME B16.9, buttwelding; or ASME B16.11, socket-welding type for welded joints.
- F. Steel Flanges and Flanged Fittings: ASME B16.5.
- G. Grooved-End Fittings for Steel Pipe: UL-listed and FM-approved, ASTM A 536, Grade 65-45-12 ductile iron or ASTM A 47 Grade 32510 malleable iron, with grooves or shoulders designed to accept grooved couplings.

2.05 SPECIALLY LISTED FITTINGS

- A. CPVC Fittings: ASTM F 437, threaded fittings.
- B. CPVC Schedule 40 Fittings: ASTM F 438, socket type fittings.
- C. CPVC Schedule 80 Fittings: ASTM F 439, socket type fittings.

2.06 JOINING MATERIALS

- A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for joining materials not included in this Section.
- B. Flanged Joints for Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.
- C. Couplings for Grooved-End Steel Pipe and Grooved-End Ferrous Fittings: UL 213, AWWA C606, ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing, with enamel finish. Include synthetic-rubber gasket with central-cavity, pressure-responsive design; ASTM A 183 carbon-steel bolts and nuts; and locking pin, toggle, or lugs to secure grooved pipe and fittings.
- D. Couplings for Grooved-End Ductile-Iron Pipe and Fittings: UL 213, AWWA C606, ASTM A 536 ductile-iron housing, with enamel finish. Include synthetic-rubber gasket with central-cavity, pressure-responsive design, and ASTM A 183 carbon-steel bolts and nuts to secure grooved pipe and fittings.

2.07 FIRE PROTECTION SERVICE VALVES

- A. General: UL-listed and FM-approved, with 175-psig (1200 kPa) non-shock minimum working pressure rating.
 - 1. Option: Valves for use with grooved piping may be grooved type.
- B. Gate Valves, 2 Inches (50 mm) and Smaller: UL 262, cast-bronze, threaded ends, solid wedge, outside screw and yoke, rising stem.
- C. Gate Valves, 2-½ Inches (65 mm) and Larger: UL 262, iron body, bronze mounted, taper wedge, outside screw and yoke, rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
- D. Gate Valves, 2-½ Inches (65 mm) and Larger for Use with Indicator Posts: UL 262, iron body, bronze mounted, solid wedge disc, non-rising stem with operating nut and flanged ends.
- E. Indicator Posts: UL 789, wall type, cast-iron body, with windows for target plates that indicate valve position, extension rod and coupling, locking device, and red enamel finish.

1. Operation: Cast Hand Wheel.
- F. Swing Check Valves, 2-½ Inches (65 mm) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze disc ring and flanged ends.
- G. Ball Drip Valves: UL 1726, automatic drain valve, ¾ -inch (20 mm) size, spring-loaded, ball check device with threaded ends.

2.08 BACKFLOW PREVENTERS

- A. General: ASSE standard backflow preventers, of size indicated for maximum flow rate indicated and maximum pressure loss indicated.
 1. Working Pressure: 150 psig (1035 kPa) minimum except where indicated otherwise.
 2. Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 3. Interior Lining: FDA-approved epoxy coating, for backflow preventers having cast-iron or steel body.
 4. Interior Components: Corrosion-resistant materials.
- B. Double-Check Backflow Prevention Assemblies: ASSE 1015, consisting of shutoff valves on inlet and outlet and strainer on inlet. Include test cocks with 2 positive-seating check valves for continuous pressure application.
 1. Pressure Loss: 5 psig (35 kPa) maximum, through middle third of flow range.

2.09 SPRINKLERS

- A. Automatic Sprinklers: With heat-responsive element conforming to:
 1. UL 199, for applications except residential.
 2. UL 1767, for early-suppression, fast-response applications.
- B. Sprinkler types and categories shall be as indicated on drawings and as required by application. Furnish automatic sprinklers with nominal ½ -inch (12.7 mm) orifice for "Ordinary" temperature classification rating except where otherwise indicated and required by application. Sprinklers in light hazard occupancies shall be of the quick- response type.
- C. Sprinkler types, features, and options include:
 1. Flush (concealed) ceiling sprinklers, including escutcheon.
 2. Recessed pendent, dry-type sprinklers.
 3. Sidewall sprinkler heads with matching escutcheon
 4. Upright sprinklers.
 5. Pendent sprinklers with ceiling escutcheon.
- D. Sprinkler Finishes: Chrome-plated, white painted, or bronze.
- E. Sprinkler Escutcheons: Materials, types, and finishes as required by sprinkler mounting applications. Escutcheons for concealed sprinklers are specified with sprinklers. Escutcheons for recessed or pendent sprinklers shall match the finish of the sprinkler as called for on drawings.
- F. Sprinkler Cabinets: Finished steel cabinet and hinged cover, with space for minimum of 6 spare sprinklers plus sprinkler wrench, suitable for wall mounting. Include number of sprinklers required by NFPA 13 and 1 wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each style sprinkler on Project.

2.10 SPECIALTY SPRINKLER FITTINGS

- A. Specialty Fittings: UL-listed and FM-approved, made of steel, ductile iron, or other materials compatible with system materials and applications where used.
- B. Locking-Lug Fittings: UL 213, ductile-iron body with locking-lug ends, for use with plain end steel pipe.
- C. Mechanical-"T" Fittings: UL 213, ductile-iron housing with pressure-responsive gasket, bolts, and threaded or locking-lug outlet.
- D. Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gaskets, bolts, and threaded or locking-lug outlets.
- E. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.
- F. Sprinkler Alarm Test Fittings: Ductile-iron housing with 1-½ -inch (40 mm) inlet and outlet, integral test valves, combination orifice and sight glass, and threaded or locking-lug ends.
- G. Sprinkler Guards: Reliable Model C-1 or approved equal

2.11 FIRE DEPARTMENT CONNECTIONS

- A. Exposed, Wall-Mounted or Free-Standing Fire Department Connections: UL 405, cast-brass body; NH-standard thread inlets according to NFPA 1963 and matching local fire department threads; and threaded NPS outlet. Include lugged cap, gasket, and chain; lugged swivel connection and drop clappers for each hose connection inlet; and round wall escutcheon plate with marking "AUTO SPKR." Also, include a check valve at each fire department connection.

2.12 ALARM DEVICES

- A. Alarm Devices: Types and sizes that will match piping and equipment connections.
- B. Electric Alarm Bells: UL Listed, 8" round, electric type detector, and designed for horizontal or vertical installation. Polarized, mount to 4" square outlet box, high-efficiency motor driven striker, red finish; on outdoor installations provide #WBB weatherproof back box, 30 aM at 8-24 volts d.c. (See Fire Protection Drawings).
- C. Supervisory Switches: UL 753, for valves, electrical-supervision type, SPDT (single-pole, double-throw), normally closed contacts, designed to signal controlled valve in other than full open position (See Fire Protection Drawings).

2.13 PRESSURE GAUGES

- A. Pressure Gauges: UL 393, 3-½ to 4-½ inches (90 to 115 mm) diameter dial with dial range of 0-250 psig (0-1600 kPa).

PART 3 - EXECUTION

3.01 SPRINKLER AND STANDPIPE SYSTEM PIPING APPLICATIONS

- A. Refer to Part 2 of this Section for detailed specifications on pipe and fittings products listed below. Use pipe, tube, fittings, and joining methods according to the following applications. Piping may be joined with flanges instead of indicated joints. Use grooved-end fittings with grooved couplings that are made by the same manufacturer and that comply with listing when used together for grooved- coupling joints.
- B. Under slab fire protection water piping: Use only lined ductile iron pipe, 150psi, ANSI/AWWA C-151/A21.51.
- C. Pipe Between Fire Department Connections and Check Valves: Use galvanized-steel pipe instead of black-steel pipe when steel pipe is specified. Do not use welded joints.
- D. Sizes 2 Inches (50 mm) and Smaller: (Above finish floor) ASTM A 53, A 135, or A 795; threadable light-wall pipe, Schedule 40 steel pipe with cut-groove ends, grooved-end steel pipe fittings, and grooved-coupling joints; or with threaded joints and fittings.
- E. Sizes 2-½ Inches (65 mm) and larger: (Above finish floor) ASTM A 135 or A 795, Schedule 10 steel pipe with rolled- groove ends, grooved-end steel pipe fittings, and grooved-coupling joints.
- F. Specially Listed CPVC Pipe & Fittings 3 Inches and Smaller:
1. Use only on wet-pipe portion of fire sprinkler system. Do not use on dry-pipe portion.
 2. Use only in "Light Hazard Occupancy" Areas/Rooms.
 3. Use only in Areas/Rooms/Spaces where the service temperature will not exceed 150dgF. at 175psi.
 4. Use only where piping is concealed by ceilings or other construction; not permitted to be exposed. Exceptions are permitted as specifically allowed by NFPA 13.

3.02 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use gate, ball, or butterfly valves.
 2. Throttling Duty: Use globe, ball, or butterfly valves.

3.03 JOINT CONSTRUCTION

- A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for basic piping joint construction.
- B. Grooved-End Pipe and Grooved-End Fitting Joints: Use grooved-end fittings and grooved couplings that are made by the same manufacturer and that are listed for use together. Groove pipe and assemble joints with grooved coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions. Grooves may be cut or rolled where permitted by code for the specific type of pipe being used.
- C. Locking-Lug Joints: Follow manufacturer's written instructions.
- D. Dissimilar Materials Piping Joints: Make joints using adapters compatible with both piping materials.

3.04 SERVICE ENTRANCE PIPING

- A. Connect fire protection piping to water service piping of size and in location indicated for service entrance to building. Water service piping is specified in Section 33 00 00 - "SITE PIPING."
- B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water supply piping.
- C. Piping for service entrance from 5'-0" outside the building, up to the anchored flange shall be cement-lined ductile iron with mechanical joints. Install concrete reaction blocking at each tee and elbow. Do not substitute long threaded rods for blocking.

3.05 TESTING PIPING SYSTEMS

- A. See Section 20 04 00 – “TESTING PIPING SYSTEMS” for required pressure tests.

3.06 PIPING INSTALLATIONS

- A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for basic piping installation.
- B. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping. Install piping as indicated, as far as practical. All piping shall be installed as high as possible.
 - 1. Deviations from approved "working plans" for sprinkler piping require written approval from the authority having jurisdiction. File written approval with the Engineer prior to deviating from approved "working plans."
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes 2 inches (50 mm) and smaller. Unions are not required on flanged devices or in piping installations using grooved couplings.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2 -inch (65 mm) and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install ball drip valves to drain piping between fire department connections and check valves, and where indicated. Drain to floor drain or outside building.
- I. Install alarm devices in piping systems. Inform the General Contractor of the locations of all alarm devices to facilitate coordination with the fire alarm or electrical subcontractor.
- J. Install pressure gages on riser or feed main. Include pressure gauges with connection not less than 1/4 inch (7 mm) and with soft metal seated globe valve. Install gauges to permit removal, and install where they will not be subject to freezing.

3.07 HANGERS AND SUPPORTS

- A. Comply with NFPA 13. Install according to NFPA 13.
 - 1. Install hanger and support spacing and locations for steel piping joined with grooved mechanical couplings according to manufacturer's written instructions for rigid systems. Reference table below.

Nominal Pipe Size (in.)	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8
Steel Pipe Except Threaded Lightwall	N/A	12-0	12-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0

Threaded Lightwall Steel Pipe	N/A	12-0	12-0	12-0	12-0	12-0	12-0	N/A	N/A	N/A	N/A	N/A
Copper Tube (CTS)	8-0	8-0	10-0	10-0	12-0	12-0	12-0	15-0	15-0	15-0	15-0	15-0
CPVC (IPS)	5-6	6-0	6-6	7-0	8-0	9-0	10-0	N/A	N/A	N/A	N/A	N/A

For SI Units: 1 in. = 25.4 mm; 1 ft = 0.3048 m.

Note: (IPS) Iron Pipe Size. CTS Copper Tube Size.

3.08 SPECIALTY SPRINKLER FITTING INSTALLATIONS

- A. Install specialty sprinkler fittings according to manufacturer's written instructions.

3.09 VALVE INSTALLATIONS

- A. Refer to Section 20 05 00 - "VALVES" for installation of general duty valves. Install fire protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and the authority having jurisdiction.
- B. Gate Valves: Install fire protection service valves supervised open, located to control sources of water supply except from fire department connections. Where there is more than 1 control valve, provide permanently marked identification signs indicating portion of system controlled by each valve.
- C. Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain line connection.

3.10 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Comply with plumbing code and authority with jurisdiction. Do not install a bypass around the backflow preventer.

3.11 SPRINKLER APPLICATIONS

- A. Install the types of sprinklers indicated on the drawings. Where drawings do not indicate, use the types listed below:
 - 1. Rooms without Ceilings: Upright brass sprinklers.
 - 2. Rooms with Suspended Ceilings: Chrome pendant recessed sprinklers with chrome escutcheons.
 - 3. Wall Mounting: Sidewall sprinklers (chrome).
 - 4. Spaces Subject to Freezing: Upright or pendent dry-type.
 - 5. Special Applications: Use extended-coverage, flow- control, and quick response sprinklers where indicated.
 - 6. In gymnasiums and other rooms where sprinkler head damage is likely, install guards on all heads.

3.12 SPRINKLER FINISHES

- A. Use sprinklers with finishes as called for on drawings. Where drawings do not indicate, use finishes as follows:
 - 1. Unfinished areas and rooms without ceilings: bronze.
 - 2. Areas with ceilings: chrome plated.
 - 3. Sidewall sprinklers: chrome plated.

3.13 SPRINKLER LOCATIONS

- A. Where drawings require it, sprinklers shall be centered in acoustical tile panels.
- B. If not specified on drawings, sprinklers shall be located with their center at least 6" from ceiling grid lines.

3.14 FIRE DEPARTMENT CONNECTION INSTALLATIONS

- A. Install fire department connections of types and features indicated in locations indicated.
- B. Install check valve at each fire department connection.
- C. Install ball drip valves at each check valve for fire department connection and where indicated. Drain to a floor drain or outside building.

3.15 CONNECTIONS

- A. Connect the specified water supplies to standpipe and sprinkler systems.
- B. Electrical Connections: Power wiring is specified in Division 26.
- C. Connect alarm devices to fire alarm system.

3.16 FIELD QUALITY CONTROL

- A. Perform field acceptance tests of each fire protection system.
 - 1. Flush, test, and inspect sprinkler piping systems according to NFPA 13 Chapter "System Acceptance."
- B. Replace piping system components that do not pass test procedures specified, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Report test results promptly and in writing to authority having jurisdiction when required.

3.17 CLEANING

- A. Clean dirt and debris from sprinklers. Replace sprinklers having any paint other than factory finish with new sprinklers. Cleaning and reuse of painted sprinklers is prohibited.

3.18 COMMISSIONING

- A. See Section 20 02 00 "Contract Close-out & Commissioning".

END OF SECTION 21 13 13

SECTION 22 00 00 - PLUMBING**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Solicitation Documents.
 4. General Conditions.
 5. Supplementary Conditions.
 2. Architectural Division.

1.02 WORK INCLUDES

- A. All piping, fittings, meters, valves, hangers and other accessories specified and shown on the drawings for a complete:
1. Domestic cold and hot water piping system.
 2. Sanitary waste and vent piping system, including all necessary excavating and backfilling to 5'-0" outside building foundation.
 3. Roughing in and final connection to equipment provided by Owner.
 4. Non-freeze hose bibbs, hose bibbs, and required vacuum breakers.
 5. Testing, flushing, and cleaning, for all piping systems and chlorination of the domestic water piping system.
 6. Water heaters, expansion tanks and storage tanks.
 7. Backflow preventers.
 8. Gas piping system.
 9. Water treatment system for icemakers, etc.
 10. Thermostatic water tempering valves.
- B. Fees, permits and licenses; see Section 20 01 00, 1.02 "Work Includes".

1.03 RELATED WORK

- A. 20 01 00 "General Provisions"
B. 20 03 00 "Materials and Methods"
C. 20 04 00 "Testing Piping Systems"
D. 20 05 00 "Valves"
E. 20 06 00 "Mechanical Identification
F. 22 07 19 "Piping Insulation"
G. 22 40 00 "Plumbing Fixtures and Trim"
H. 23 11 23 "Gas Piping Systems"

1.04 SUBMITTALS

- A. Submit certificates of compliance for pipe, fittings and valves specified under this section.
B. Provide submittals in accordance with "Plumbing Equipment Schedule":
C. Provide all identification, operating instructions, parts lists, wiring and control diagrams for all equipment installed under this section.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Comply with current edition of following:
1. International Plumbing Code, latest adopted edition.
 2. Pipe and fittings shall conform to applicable ANSI, AWWA, ASTM, and USASI standards referenced for those products.

- B. No plumbing fixture, special equipment, device or piping shall be installed which will provide cross connection or interconnection between distributing supply for drinking water or domestic water and polluted supply or waste so as to make possible backflow or back-siphonage of sewage or polluted water into potable water supply system.
- C. Where possibility of back-siphonage exists, water supplied to fixture shall be introduced through a suitable vacuum breaker installed at code minimum distance above fixture.
- D. All piping systems shall be tested as required by the applicable specification section. Where required, test pressure shall be maintained on the piping system while adjacent construction is in progress.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Water Hammer Arrestors
 - 1. Sioux Chief.
 - 2. Watts.
- B. Unions (in copper pipe 2 in. and smaller)
 - 1. Anaconda.
 - 2. Mueller.
 - 3. Chase Brass.
 - 4. Watts
- C. Flanged Unions
 - 1. Cranelap.
 - 2. Van Stone.
 - 3. Grinnell.
- D. Flange Connections
 - 1. Cranite.
 - 2. Garlock.
- E. Cleanouts, Floor Drains, and Roof Drains
 - 1. Jay R. Smith.
 - 2. Wade.
 - 3. Josam.
 - 4. Zurn.
 - 5. Watts
- F. Trench Drains
 - 1. Zurn.
 - 2. Jay R. Smith.
 - 3. Watts.
- G. Non-freeze Hose Bibbs
 - 1. Woodford.
 - 2. Josam.
 - 3. Wade.
 - 4. Zurn.
 - 5. Watts
- H. Hose Bibbs
 - 1. Jay R. Smith.
 - 2. Woodford.
 - 3. Watts.
- I. Expansion Tanks
 - 1. Amtrol.
 - 2. Watts.
 - 3. State
- J. Backflow Preventers
 - 1. Watts.
 - 2. Wilkins.
 - 3. Ames.
- K. Water Heaters
 - 1. A. O. Smith.
 - 2. Lochinvar.
 - 3. State – Commercial only.
 - 4. Bradford White.
- L. Thermostatic Tempering Valves
 - 1. Leonard
 - 2. Watts.
- M. Acid Waste Piping and Neutralization Basin
 - 1. Orion.
 - 2. Zurn.
 - 3. Charlotte.
- N. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 DOMESTIC COLD AND HOT WATER PIPING SYSTEMS

- A. All piping and fittings shall be manufactured in the United States. Each length of pipe and each fitting shall be marked with the manufacturer's name or trademark and the specification code to which it conforms.
- B. At each location indicated on the drawings, install a Sioux Chief #653-BS ¾" water hammer arrestor, 7 cu. in. or equal. Air chambers are not acceptable.
- C. All supply connections to plumbing fixtures and equipment shall be galvanized or copper piping up to face of wall and chromium plated brass piping and fittings for exposed connections. Each fixture shall have a shut off valve at the fixture.
- D. Each water connection to a plumbing fixture or item of equipment having a submerged inlet or hose end attached shall be provided with a vacuum breaker to prevent back-siphonage of contaminated water into drinking supply, approved by local and state health authorities.

2.03 PIPE AND TUBE MATERIALS

- A. See Part 3 Article "Pipe and Fittings Applications" for the application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems:
 1. Hard Copper Tube: ASTM B 88, Types K, and L, water tube, drawn temper.
 2. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
 3. Hubless, Cast-Iron Soil Pipe: CISPI 301, All Cast Iron Soil Pipe And Fittings Shall Be Marked With The Collective Trademark Of The Cast Iron Soil Pipe Institute.
 4. Poly Vinyl Chloride (PVC) Plastic, DWV Pipe: ASTM D 2665, Schedule 40; plain ends.
 5. Schedule 40 Black Steel: A53 ERW, Grade B.
 6. Schedule 10 Black Steel: A135 ERW or A795 ERW, Grade B.
 7. Note - "Foam Core" Pipe, ASTM F-891 is not approved.
 8. Polypropylene Pipe: ASTM D4101, Flame Retardant, Schedule 40, Factory Grooved Ends. (Corrosive waste piping in non-fire rated areas.)
 9. Polyvinylidene PVDF Pipe: ASTM E84 (UL723), ASTM B117, Schedule 40, Factory Grooved Ends. (Corrosive waste piping in fire rated plenums)
 10. Polypropylene Pipe: ASTM F1412, Flame Retardant, Schedule 40, Plain Ends. (Corrosive Waste Piping for Below Grade Under-slab.)
 11. CPVC Corrosive Waste Piping: ASTM D1784 (Cell Classification 23447). ASTM F441 (Schedule 40 Dimensions) CPVC Lab Waste Piping.
 12. CPVC (Chlorinated Poly Vinyl Chloride) Plastic Pressure Piping: ASTM D2846, SDR-11 or ASTM D1784 and D1785, Schedule 80.

2.04 PIPE AND TUBE FITTINGS

- A. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22.
- B. Copper Tube, Grooved-End Mechanical Fittings: ASTM B 75, copper tube and ASTM B 584 bronze castings.
- C. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.
 1. Threaded Ends: Threads conforming to ASME B1.20.1.
- D. Mechanically Formed Outlets: Manufacturer's standard written procedure for forming tee-branch outlet from pipe and tube.
- E. Malleable-Iron Unions: ASME B16.39, Class 150 hexagonal stock, with ball-and-socket joint, metal-to-metal bronze seating surfaces, and female threaded ends having threads conforming to ASME B1.20.1.
- F. Malleable-Iron Threaded Fittings: ASME B16.39, Class 150, standard pattern, with threads conforming to ASME B1.20.1.
- G. Hubless, Cast-Iron Soil Pipe Fittings: CISPI 301, All Cast Iron Soil Pipe And Fittings Shall Be Marked With The Collective Trademark Of The Cast Iron Soil Pipe Institute.
- H. Poly Vinyl Chloride (PVC) Plastic, DWV Pipe Fittings: ASTM D 2665, made to ASTM D 3311; socket-type; drain, waste, and vent pipe patterns.
- I. Poly Vinyl Chloride (PVC) Plastic, Schedule 40, Socket-Type Pipe Fittings: ASTM D 2466.

2.05 JOINING MATERIALS

- A. Solder, brazing, and welding filler metals are specified in Part 3 of this Section.
- B. Cast-Iron Soil Pipe and Fittings: ASTM C 564 neoprene rubber gaskets and lubricant.
- C. Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: The following materials apply:
 - 1. Push-On Joints: AWWA C111 rubber gaskets and lubricant.
 - 2. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-t\strength steel bolts and nuts, and rubber gaskets.
 - 3. Flanged Joints: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.
- D. Gasket-Type couplings for Plain-End, Nonpressure System Pipe: Rubber or elastomeric compression gasket, made to match pipe inside diameter or hub and adjoining pipe outside diameter.
 - 1. Gaskets: ASTM C 564, rubber for cast-iron soil pipe and ASTM F 477, elastomeric seal for plastic pipe. Gaskets for dissimilar or other pipe materials shall be compatible with pipe materials being joined.
- E. Couplings for Grooved-End Copper Tube and Grooved- End Copper Fittings: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing having copper-colored enamel finish, with synthetic-rubber gasket having central- cavity, pressure-responsive design and suitable for hot water, with ASTM A 183 carbon-steel bolts and nuts.
- F. Schedule 40 Black Steel Pipe and Fittings - 2" and Smaller: Screwed joints with malleable-iron threaded fittings.
- G. Schedule 40 Black Steel Pipe and Fittings - 2-½" and Larger: Welded joints with standard weight welding fittings.
- H. Couplings for Schedule 10 Black Steel Pipe 2" and Larger: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing having orange-colored enamel finish, with synthetic-rubber gasket having central cavity, pressure responsive design and suitable for hot water, with ASTM A 183 carbon-steel bolts and nuts.

2.06 PIPE SPECIALTIES

- A. Unions in copper pipe 2 in. and smaller shall be brass solder joint unions constructed for 150 psi working pressure.
- B. Unions in steel pipe 2 inch and smaller shall be screwed, malleable iron, brass to steel type (F.S. WW-U-531c Class 1) for 150 psi working pressure.
- C. Unions 2-½ in. in size and larger shall be companion flanges. (ANSI B16.1). Flanged unions shall be over welding nipples welded into pipelines.
- D. Flanges shall be forged steel flanges (ANSI B16.5) constructed for 150 psi. working pressure. Bolts for flanged joints shall be made of bolt steel and shall have clean cut threads with upset square heads and semi-flush hexagonal cold pressed nuts (F.S. WW-F406b).
- E. Flange connections shall be made up with high pressure special type graphited 1/16 in. sheet packing (ANSI B16.21); or rubber, for temperature up to 200°F (F.S. HH-G-156 class A).
- F. Dielectric unions suitable for dielectric service shall be provided at pipe connections between steel or cast iron piping and copper tubing.

2.07 GAS PIPING

- A. See Section 23 11 00 - GAS PIPING SYSTEMS for gas piping materials.
- B. See Section 20 04 00 – “Testing Piping Systems” for required tests.

2.08 FLOOR DRAINS

- A. **If not noted on plans, use the following:**
- B. Floor drains shall conform to the following:
 - 1. FD: cast iron floor drain with satin nickel bronze vandal proof adjustable strainer.
 - a. Zurn ZN-415-B (see Drawings for sizes).
 - 2. Floor drains in slab-on-grade-floors shall not be flashed, shall have black iron bodies with nickel bronze covers and strainers, and must be located to properly serve associated equipment and be accessible for cleaning as approved by the Engineer.
 - 3. Floor drains shall have covers and strainers securely fastened by countersunk, tamperproof, brass machine screws.

4. All floor drains shall have a 5" minimum strainer size. On floor drains larger than 2", strainer size shall be 3" or more larger than the drain size unless specifically shown otherwise on the drawings.
- C. All floor drains shall be by the same manufacturer. Furnish and install a deep seal "P" trap at each floor drain.

2.09 CLEANOUTS

A. **If not noted on plans, use the following:**

- B. All cleanouts shall be by the same manufacturer.
1. Exposed piping or piping above ceiling: Cast iron body ferrule with brass raised head, straight threaded coating plug having tapered shoulder.
 2. Concrete floors or tile floors: Cast iron floor cleanout, adjustable threaded housing, round satin bronze scoriated top, bronze tapered plug, vandal proof.
 3. Tile floors: Cast iron floor cleanout, adjustable threaded housing, satin bronze top, recessed for tile bronze taper plug, vandal proof.
 - a. Zurn ZN-1400.
 4. Walls: Cast iron ferrule, brass plug, and vandal proof stainless steel flat access cover.
 - a. Zurn ZAB-1441.
 5. Carpeted floors: Cast iron floor cleanout, adjustable threaded housing, bronze taper plug satin bronze top with carpet marker
 - a. Zurn ZN-1400-CF.
 6. Outdoor: Coordinate placement of concrete pads with the general contractor, cast iron cleanout, adjustable threaded housing, round top, bronze tapered plug, vandal proof.
 - a. Zurn ZN-1474 with Z1449 cleanout barrel.

2.10 TRAPS

- A. Trap all fixtures having waste connections with a water seal placed as close to fixture as possible. Provide all required traps including traps not furnished in combination with fixture and equipment.
- B. Traps for lavatories or sinks shall be chrome plated 17 gauge brass unless noted otherwise on drawings.
- C. Traps for laboratory table sinks or other sinks which may contain acids or other chemicals shall be heavy duty polyethylene.

2.11 BACKFLOW PREVENTERS

- A. General: ASSE standard backflow preventers, of size indicated for maximum flow rate indicated and maximum pressure loss indicated.
 1. Working Pressure: 150 psig (1035 kPa) minimum except where indicated otherwise.
 2. Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 3. Interior Lining: FDA-approved epoxy coating, for backflow preventers having cast-iron or steel body.
 4. Interior Components: Corrosion-resistant materials.
- B. Double-Check Backflow Prevention Assemblies: ASSE 1015, consisting of shutoff valves on inlet and outlet and strainer on inlet. Include test cocks with 2 positive-seating check valves for continuous pressure application.
 1. Pressure Loss: 5 psig (35 kPa) maximum, through middle third of flow range.
- C. Reduced-pressure Zone Assemblies: ASSE Standard 1013, consisting of reduced-pressure assembly with shutoff valves on inlet and outlet and strainer on inlet. Include test cocks and bronze air gap fitting.
 1. Pressure loss – static pressure loss not to exceed 8 psi. Pressure loss at rated flow not to exceed 12 psi.

2.12 NON-FREEZE HOSE BIB

A. **If not noted on plans, use the following:**

- B. Non-freeze anti-siphon hose bibbs shall be full recessed box construction with satin nickel bronze box and hinged key-operated cover with removable operator handle furnished with each hose bibbs. Brass working parts and casing, renewable nylon valve seat, 3/4" IPS inlet connection and integral backflow preventer, 3/4" male thread straight hose connection

- a. Woodford Model No. B60.

2.13 HOSE BIBBS

- A. **If not noted on plans, use the following:**
- B. Hose bibbs shall be ¾" size, chrome plated, with removable "T" handle key, wall clamp and vacuum breaker.
 - a. Woodford Model No. 24.

2.14 THERMOSTATIC TEMPERING VALVES

- A. Water tempering valves (where shown on drawings) shall be rated for use for mixing water for showers or hand washing. They shall control the water temperature within $\pm 2^{\circ}\text{F}$. of setpoint at any flow from zero to their maximum rating. Valves which require a minimum flow, a pressure drop over 5 psi, or are 2-stage are not acceptable.
- B. Each centrally-located water tempering valve shall be equipped with a thermometer in the tempered water line, calibrated in degrees F. Valves installed to control only one fixture are not required to have a thermometer unless so shown on the drawings.

2.15 WATER HEATER

- A. Unless noted otherwise on the drawings, water heater shall be gas fired or electric storage type, U.L. listed and in compliance with ASHRAE 90A energy efficiency requirements.
- B. Tank shall be glass-lined with a working pressure of 150 psi and shall be equipped with magnesium anodes. Tank shall have a storage capacity as indicated on the drawings.
- C. Heater shall have a steel jacket with baked enamel finish and shall be fully insulated. Heater shall be equipped with thermostat with automatic overheat safety control, immersion aquastat and single heating element. Provide ASME pressure and temperature relief valve.

2.16 EXPANSION TANK – BLADDER TYPE

- A. ASME rated pre-charged bladder-type pressure vessels are designed to absorb the expansion forces of heating/cooling system water while maintaining proper system pressurization under varying operating conditions. The heavy duty bladder shall contain system water to eliminate tank corrosion and waterlogging problems.
- B. Operating Data:
 - Maximum working pressure. 125 PSI
 - Maximum operating temperature. . . 240°F
- C. Materials of Construction:
 - System Connection: Forged Steel
 - Shell: Carbon Steel
 - Bladder: Heavy Duty Butyl Rubber
 - Designed and Constructed per ASME Section VIII, Division 1

2.17 TANK FITTINGS

- A. Furnish and install a compression tank fitting as shown on plans. It must contain an air separating trap and liquid control baffle to assure unrestricted air flow to the tank and air-free liquid flow from the tank. It must include a manual vent for adjustment of air volume in the tank. Cast iron.

PART 3 - EXECUTION

3.01 PIPE AND FITTINGS APPLICATIONS

- A. The following applications are for only inside and below the building and ending at a point 5'-0" outside the perimeter building walls. For piping from 5'-0" outside the building to the utility point of connection (POC), see Section 33 00 00 "Site Piping".
- B. Use pipe, tube, fittings, and joining methods for piping systems according to the following applications:
1. Domestic Water Distribution Piping Below Grade: Use the following:
 - a. All interior domestic water piping shall be type "K" hard drawn or Type "K" annealed (soft) copper tubing (SIL-FOS 2, FOS-FLO 7 or other silver brazing material). This is required for the water service line from the shut-off valve in the building to a point 5 feet outside the building.
 - b. All copper piping shall be installed with wrought copper fittings. Field-fabricated "T-Drill" taps are acceptable on piping 1" and larger, if silver-brazed (above-ground piping only).
 - c. Soft temper copper tubing may be used for small pipe in concealed spaces only to permit bends for roughing in.
 - d. Do not use tin-lead solder on domestic water piping. Use only approved lead-free solder or brazing material.
 2. Domestic Water Distribution Piping Above Grade: Use the following:
 - a. Hard copper tube, Type L; wrought-copper or cast-copper-alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy Sn95 solder.
 - b. Fittings Option: Mechanically formed outlets, brazing filler alloy, and brazed joints.
 - c. Fittings Option: Grooved fittings for copper piping.
 3. Optional Materials for Domestic Cold Water, Hot Water, and Hot Water Return Piping Above Grade: Use the following:
 - a. ¾" thru 2" SDR-11 CPVC pipe with solvent-cemented joints.
 - b. ¾" thru 2" Schedule 80 CPVC pipe with solvent-cemented joints.
 4. All Exterior Domestic Water Piping Below Grade:
 - a. From 5'-0" outside the building to the utility water main, see Section 33 00 00 "Site Piping"
 5. Soil, Waste, and Vent Piping Below Grade: Use the following:
 - a. Schedule 40 poly vinyl chloride (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
 6. Soil, Waste, and Vent Piping Above Grade: Use ONLY the following:
 - a. Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
 - b. PVC piping is not permitted in air-handling ceiling spaces, use only cast-iron or ductile iron pipe in these locations. See paragraph 6.a. above for cast-iron pipe specifications.
 7. All Exterior Soil and Waste Piping Below Grade:
 - a. From 5'-0" outside the building to the utility sewer main: See Section 33 00 00 "Site Piping".
 8. Storm Drainage Piping Below Grade: Use the following:
 - a. Poly (vinyl chloride) (PVC) plastic DWV pipe; PVC socket-type drain, waste, and vent pipe pattern fittings; and solvent-cemented joints.
 9. Storm Drainage Piping Above Grade: Use ONLY the following:
 - a. Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.
 - b. PVC, DWV Piping can also be used however, PVC PIPING IS NOT PERMITTED IN AIR-HANDLING SPACES ABOVE CEILINGS, such as plenum return spaces. Use only cast-iron or ductile iron pipe in these locations. See paragraph 9.a. above for cast-iron pipe specifications.
 10. All Exterior Storm Drainage Piping Below Grade:
 - a. From 5'-0" outside the building to either the point of discharge or the point of connection to a utility storm drain main. See Section 33 00 00 "Site Piping".

3.02 JOINTING OF PIPING

A. See section 20 03 00 - "MATERIALS AND METHODS", Part 3 - Execution.

3.03 EXPANSION AND CONTRACTION

A. See section 20 03 00 - "MATERIALS AND METHODS", Part 3 - Execution.

3.04 INSTALLATION OF PIPING

A. See section 20 03 00 - "MATERIALS AND METHODS", Part 3 Execution.

3.05 COLD AND HOT WATER PIPING SYSTEM

A. Above grade water piping:

1. Piping shall be run true, parallel with walls, centered in hangers and sleeves, securely supported by hangers or supports independently of connections and sleeves, anchored as required to control movement. Pipe and fittings arranged as called for and as required to permit free, unrestrained, noiseless expansion and contraction and freedom from strain on equipment.
2. All screwed piping shall be carefully cut, reamed, threaded and worked into place with springing, using a small amount of prepared lubricant on the outside threads. Branch connections shall have three elbow spring pieces to allow for movement due to expansion.
3. Valves and unions or flanges shall be suitably located to isolate each unit, branch circuit or section of piping to facilitate maintenance and/or removal of all equipment and apparatus.
4. All piping shall be installed so as to be free to expand without injury to equipment or building.
5. Plumbing water mains must pitch down to drain completely through fixtures or equipment below; provide accessible unions, brass plugs or hose valves at low points.
6. Plumbing water mains must pitch to vent completely through fixtures or equipment above.
7. All risers or down-feed drops shall be firmly supported and blocking done as necessary to prevent hammer due to vibration.
8. Provide pipe escutcheons in accordance with Section 20 03 00 - "MATERIALS AND METHODS".
9. See Section 20 04 00 - "Testing Piping Systems" for required testing of all cold and hot water piping systems.

3.06 DISINFECTION OF DOMESTIC WATER SYSTEMS WITHIN THE BUILDING

A. See Section 20 02 00 - "Contract Close-out & Commissioning".

3.07 FLUSHING WATER PIPING

A. See Section 20 02 00 - "Contract Close-out & Commissioning".

3.08 SOIL, WASTE, VENT, AND STORM PIPING SYSTEM

- A. Size of soil, waste and vent stacks and branch piping shall be as indicated on the drawings, but in no case less than required by the provisions of the applicable codes.
- B. Sewers and branches shall pitch down at a minimum of 1/8" per foot. If a greater slope is required by applicable codes, it shall be provided. Branches, arms and connections shall be sloped 1/4" per foot where possible. Provide all above-grade piping with adequate hangers as specified elsewhere.
- C. Interior underground, underfloor or in-ground piping, shall be continuously bedded with depressions for hubs on compacted sand or gravel to undisturbed soil for a minimum depth of 6" under pipe. All trenches for under-slab piping shall be backfilled with gravel up to the bottom elevation of the slab.
- D. Connections to soil, waste and drain stacks shall be at 45 degrees; those to vent stacks may be at 45 degrees or 90 degrees except vent stacks shall be connected at 45 degrees to soil, waste or drain stack.
- E. Connections to stacks and sewers shall be arranged so that operation of any fixture will not cause fluctuation of

water level in traps of other fixtures.

- F. Interior storm drain piping shall be connected to roof drains; and provided with ample offsets or expansion joints below or integral with roof drains.
- G. All thread joints shall be made up with Teflon-bearing pipe joint compound applied to male thread only. Threads exposed after joints are made up shall be painted with red lead to prevent rust. Teflon tape may be used at Contractor's option.
- H. Junctions of screwed pipe to bell and spigot cast iron shall be made with ring or half coupling screwed to end of galvanized pipe to form spigot end.
- I. Junctions in all drainage lines shall be made with "Y" branches or 1/8 bends, unless closeness of connection prevents it, in which case, where direction of flow is from horizontal to vertical, sanitary tees may be used upon the approval of the Engineer's superintendent.
- J. Compression joint installation for cast iron soil pipe:
 - 1. Fold and insert the one piece neoprene rubber gasket into the hub which has been properly cleaned.
 - 2. Apply gasket lubricant to the spigot and inside of the gasket.
 - 3. Push, draw or drive the spigot into the gasketed hub with a pulling tool or suitable device.
- K. Do not install pvc piping in air-handling ceiling spaces.
- L. See Section 20 04 00 – "Testing Piping Systems" for required testing of all soil, waste and vent piping systems.

3.09 STACKS

- A. Stacks shall impose no stress or strain on branches or connections, be plumb and straight and supported at base with 18" x 18" concrete or brick pier to undisturbed soil.
- B. Unless otherwise noted, soil, waste, drain, and vent stacks shall be concealed in walls, pipe chases, pipe shafts, etc., with cleanouts extended to accessible locations.

3.10 VENTING

- A. All plumbing fixtures shall be vented to prevent siphoning of traps. Venting shown on plans is minimum required and vents and vent stacks shall be increased in size and/or number and relocated as required, to prevent trap siphoning and to comply with applicable codes, ordinances, statutes, regulations of all governmental bodies, without increase in contract price.
- B. A vent stack shall be run parallel to each soil or waste stack to receive branch vents from fixtures and traps. Each vent stack shall originate from a soil or waste pipe at its base. Each soil or waste stack and each vent stack shall be carried through the roof. Where possible, soil, waste, or vent stacks shall be combined before passing through the roof so as to have as few roof openings as possible. Pipes running close to walls shall be offset away from such walls before passing through the roof to permit proper flashing. All vent pipes passing through the roof shall be sized as indicated on the drawings, and shall extend 12" above roof.
- C. All horizontal vent pipes shall grade up to meet the requirements of the local and state codes.
- D. Vent risers and branches shall connect to the soil and waste risers above waste of highest fixture.
- E. Air admittance valves shall be used in lieu of venting only where shown on drawings and only where prior approval is granted by the local code enforcement authority.

3.11 ROOF FLASHINGS

- A. All roof drains and plumbing piping passing through the roof membrane shall be flashed under Division 07600 of the specifications.
- B. Contractor shall insure all such items are properly flashed and made watertight.

3.12 CLEANOUTS

- A. Cleanouts for indoor sanitary and storm drainage systems shall be installed not more than 100 feet apart, including the developed length of the cleanout pipe, in all horizontal drainage lines. Where so required by local codes, place at closer intervals. A cleanout shall be provided at, or no more than two feet above the base of each vertical soil or waste stack and storm water conductor. Cleanouts shall be installed at such other points as may be necessary for adequate rodding out of drainage piping systems. Cleanouts shall be set flush with floor or

wall surfaces.

- B. Avoid placing floor cleanouts in heavy traffic areas such as the center of corridors or in doorways.

3.13 INSTALLATION OF WATER HEATER

- A. General: Install water heater in accordance with manufacturer's installation instructions. Install unit plumb and level, firmly anchored in location indicated, and maintain manufacturer's recommended clearances.
- B. Support: Orient so controls and devices needing service and maintenance have adequate access.

END OF SECTION 22 00 00

SECTION 22 07 19 - PIPING INSULATION**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Solicitation Documents.
 4. General Conditions.
 5. Supplementary Conditions.
 6. Architectural Division.

1.02 WORK INCLUDES

- A. Provide all materials, equipment, apparatus, services, methods, tools, labor, transportation, etc., required to complete the insulation of the mechanical systems as shown on the drawings and as specified.
- B. Piping system insulation shall be applied as applicable to the project. See drawings for the systems included in this project.
- C. Cold piping requiring insulation:
1. Domestic cold water piping.
 2. Interior roof drain piping above grade and roof drains bodies (including overflow drain piping).
 3. HVAC condensate piping.
 4. HVAC chilled water piping.
 5. Refrigerant piping.
- D. Hot piping requiring insulation:
1. Domestic hot water piping and tempered water piping.
 2. HVAC hot water piping.
- E. Painting and identification will be provided under Architectural Divisions or by the Contractor providing the items to be insulated. Factory sizing on outer jacketing of insulation shall be provided under this section suitable for specified finish coat of paint or identification.

1.03 SUBMITTALS

- A. Submit shop drawing in accordance with Section 20 01 00 - "GENERAL PROVISIONS" for all insulation as follows:
1. Schedule listing each type of insulation, insulation thickness, density, "K" factor, type of jacket, etc., and the service or type of work that the insulation is to apply.

1.04 CODES AND STANDARDS

- A. Where applicable, the Fire Hazard Classification of the materials herein specified shall be listed and inspected by Underwriters Laboratories, Inc. The flame spread rating (25 or less), fuel contributed and smoke developed (50 or less) as shown in the listing shall be determined by ASTM E84 "Method of Tests for Surface Burning Characteristics of Building Materials". Each product shall bear the label of Underwriters' Laboratories. All products used on this project shall be classified as "non-combustible" in National Building Code or NFPA National Fire Code.

1.05 DEFINITION

- A. The term "piping" as used in this section of the specifications shall include pipe, fittings, valves, specialties, strainers, flanges, unions, runouts, final connections, etc.

1.06 PROTECTION

- A. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Any such insulation or covering damaged prior to final acceptance of the work shall be satisfactorily repaired or replaced.
- B. Provide sturdy metal guards on all duct and pipe (whether insulated or not) subject to damage from normal maintenance operations and personnel.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Insulation
 - 1. Certain-Teed/Saint Gobain Corp.
 - 2. Owens-Corning Fiberglass Corp.
 - 3. Manville Corp.
 - 4. Knauf Fiberglass.
- B. Adhesives, Lagging, and Sealers
 - 1. Benjamin Foster.
 - 2. Insul-Coustic.
 - 3. Chicago Mastic Co.
- C. Closed Cell Elastomeric
 - 1. Armstrong.
 - 2. Halstead Industrial Products.
- D. PVC Premolded Fitting , and PVC Jacketing Valve Covers
 - 1. Insul-Coustic Corp.
 - 2. Zeston, Inc.
 - 3. Certain-Teed/Saint Gobain Corp.
 - 4. P.I.C. Plastics
 - 5. Ceel-Co.
 - 6. Johns-Manville
- E. Cellular Glass Insulation
 - 1. Pittsburg Corning Corporation (PCC)
- F. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 INSULATION APPLICATION FOR EQUIPMENT, COLD WATER, AND HOT WATER PIPING (ABOVE GROUND ONLY)

- A. "Fiberglass": Minimum 3-½ pounds per cubic foot density, fiberglass factory molded or spun pipe insulation with a "K" factor of 0.24 at 75°F. mean temperature and a factory applied fire retardant self sealing vapor barrier "ASJ" jacket.
- B. "Armaflex": At the Contractor's option (for interior fully concealed piping only), (Note: Piping above suspended ceilings is not considered fully concealed..) 25/50-rated, closed-cell elastomeric thermal insulation equal to "Armstrong - Armaflex" may be used. Install in full accordance with the manufacturer's recommendations, including provisions for cementing joints and insulating fittings (Note: Polyolefin insulation will not be approved as a substitute for Armaflex.) Armaflex shall also be used for refrigerant piping.
- C. "Armaflex-Sheet or Roll": For miscellaneous HVAC specialties only, 25/50 -rated, closed-cell elastomeric thermal insulation equal to "Armstrong-Armaflex" sheet or roll. Install in full accordance with the manufacturer's recommendations, including provisions for cementing joints and insulating fittings.

2.03 HVAC CHILLED AND HOT WATER PIPING INSULATION (UNDERGROUND ONLY)

- A. "Foamglass": Minimum 8 lb/ft³ density, (underground only) cellular glass insulation factory molded, with a "K" factor of .33 at 75° mean temperature. Insulation shall be fully jacketed with a field applied with a bituminous resin, reinforced glass fabric covered with an aluminized mylar film and paper. Jacket shall be equal to PPC Pittwrap SS-II.

2.04 PREMOLDED PIPING COVERS

- A. Premolded piping covers shall be factory made of one piece polyvinyl chloride - 20 mil minimum.

2.05 PREMOLDED FITTING AND VALVE COVERS

- A. Premolded fitting and valve covers shall be factory made of one piece polyvinyl chloride - 30 mil minimum. Covers shall overlap the adjoining pipe insulation.

2.06 ADHESIVES, LAGGING, AND SEALERS

- A. Adhesives, lagging and sealers shall be as recommended by the insulation manufacturers. Where applicable, they shall include an anti-vermin and fungicidal agent and shall be non-toxic and non-flammable.
- B. Jacket (PVC) adhesive, lagging and sealers shall be as recommended by the manufacturers. Jackets (PVC) shall be sealed with an all white welding adhesive on all longitudinal and circumpheral seams.

2.07 ALUMINUM JACKET

- A. Aluminum jacket shall be constructed from aluminum alloy conforming to ASTM B-209. Install in full accordance with the manufacturer's recommendations, including provisions for cementing joints and insulating fittings.
- B. .016" thk. aluminum jacket, with moisture barrier, shall be field applied over all exterior piping, fittings, and valves.
- C. Provide pre-molded .016" thk. aluminum jacket covers at all valves and fittings.
- D. Joints shall be sealed with preformed 2" butt strap with sealant over the seam and secured with 1/2" aluminum band and wing seal.

PART 3 - EXECUTION

3.01 PREPARATION/GENERAL REQUIREMENTS

- A. Clean all piping, fittings, and hangers thoroughly to remove all pipe joint compound, soldering flux, cutting oil, rust, plaster, and dirt before insulation is applied. Insulation shall be applied on clean dry surfaces only. Piping shall have been tested and approved before covering.
- B. Insulation work shall be installed by competent applicators regularly employed by insulating contractors or manufacturers.
- C. Exposed insulated ducts and piping shall be provided with a finish of an adequate surface for a final coat of paint. Pre- sized jackets, aluminum, vinyl and other pre-finished jackets are acceptable as installed, however, canvas and similar material shall be filled and sealed or dipped if necessary to provide a good surface for painting.
- D. At Contractor's option, canvas jacket may be replaced by glass cloth.
- E. Vapor barriers on cold surfaces and piping must be continuous through walls, sleeves, hangers, supports, etc. Stapling of vapor barrier jackets will not be permitted.
- F. Provide saddles, shields, metal protectors and other appurtenances necessary to prevent crushing of insulation at hangers, rollers, supports and anchors. Provide rigid insulation blocks at saddles.

3.02 PIPING INSULATION

- A. Insulate all above-ground piping systems, (except gas piping, air piping, sprinkler piping, and DWV piping) with piping insulation of specified type and thickness:

<u>Type of System or Pipe</u>	<u>Insulation Thickness</u>	
	<u>Runouts up to 2"</u>	<u>Mains</u>
1. Domestic cold water piping, domestic hot water piping, hot water return piping, tempered water piping, tempered water return piping, (above ground).	----- 1/2"-----	-----1"-----
2. HVAC hot water piping and HVAC hot water equipment. (up to 3").	----- 1/2"-----	-----1"-----
3. HVAC chilled water piping and HVAC hot water lines (over 3").	-----	-----1 1/2"-----
4. HVAC condensate piping	-----	-----1/2"-----
5. Refrigerant piping	-----	-----3/4"-----

(Liquid lines on units smaller than 5 tons need not be insulated.)

6. Miscellaneous HVAC Specialties----- 1/2”
 (Include expansion tanks, headers, air separators, pump bodies, and any other (sheet or roll stock) surface which may produce condensation or give off heat during system operation.)

B. Runouts are individual branches, to units not exceeding 12’-0” in length.

C. Installation of insulation shall be as follows:

1. Insulate all hydronic lines with the materials specified above. Install insulation neatly and securely.
2. Insulate headers and lines, air separators, etc. in the mechanical room. Insulate accessories that will produce condensation or give off heat during operation. Chilled water pump bodies shall be insulated. Hot water pumps are not required to be insulated.
3. Pipe: Butt all joints firmly together. Cover joints with 3” butt strips. Smoothly secure all jacket laps and joints strips with adhesive. Self-sealing laps shall be applied according to manufacturers recommendations. Ends of pipe insulation shall be sealed off with a vapor barrier coating at all fittings and valves and at intervals of 21 feet on continuous runs.
4. Fittings and Valves: Insulate with molded fiberglass fittings, foamed plastic insulation, segments of pipe covering or firmly compressed foil faced fiberglass blankets. Vapor seal by applying a layer of open weave glass cloth embedded between two coats of vapor barrier mastic.
5. Insulation of hoses at unit connections shall be done using “Armaflex” tubular insulation. Do not use pre-slit insulation. Install foam tape as necessary to prevent condensation at joints in insulation.

END OF SECTION 22 07 19

SECTION 22 40 00 - PLUMBING FIXTURES**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Solicitation Documents.
 4. General Conditions.
 5. Supplementary Conditions.
 2. Architectural Division.

1.02 WORK INCLUDES

- A. All plumbing fixtures, including supply and waste fittings, stops, trim, brackets, carriers, etc. specified, shown on the drawings and required for complete installation.
- B. All piping, fittings, valves, trim, stops, etc. specified, shown on the drawings and required for rough-in and final connection to Equipment furnished by Owner.
- C. Scald protection devices as required for all fixtures requiring such protection per the applicable codes. This may include central or distributed thermostatic mixing valves.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 20 01 00 - "GENERAL PROVISIONS" for the following:
1. Plumbing fixtures and trim.
 2. Chair carriers.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with current edition of the following:
1. Vitreous china fixture, NBS-CS-CS20.
 2. Plumbing fixtures (land use), FS-WW-P-541.
 3. Enameled iron fixtures, NBS-CS-CS77.
- B. No plumbing fixture, special equipment, device or piping shall be installed which will provide cross connection or interconnection between potable water system and polluted water or sewage system so as to make possible backflow or back siphonage of sewage or polluted water into the potable water supply system.
- C. Where possibility of back siphonage exists, water supplied to fixture shall be introduced through a suitable vacuum breaker installed at code minimum height.
- D. The water system of electric water coolers shall be manufactured of pure copper components only (completely lead free material). The water ways shall not contain any internal plating or coatings. All joints shall be made using silver solder brazing alloy. No lead or soft solder shall be used.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Brass (all fixtures except showers)
1. Zurn.
 2. Delta-Commercial (only)
 3. Chicago Faucet.
 4. T & S Brass.
- B. Brass (for showers only)
1. Chicago Faucet
 2. Symmons
 3. Bradley
 4. Delta-commercial (only)
- C. Electronic Brass
1. Gerber.
 2. Toto.

- 3. Sloan.
- D. Electric Water Coolers
 - 1. Elkay.
 - 2. Halsey-Taylor.
 - 3. Oasis.
 - 4. Haws.
- E. Flush Valves (Manual Type)
 - 1. Sloan Royal.
 - 2. Zurn.
 - 3. Toto.
 - 4. Gerber.
- F. Electronic Flush Valves
 - 1. Zurn.
 - 2. Sloan.
 - 3. Toto.
 - 4. Gerber.
- G. Mop Service Basins
 - 1. Fiat.
 - 2. Stern-Williams.
 - 3. Jonespec.
 - 4. Zurn.
- H. Seats
 - 1. Bemis.
 - 2. Olsonite.
 - 3. Church.
 - 4. Toto
- I. Sinks
 - 1. Elkay.
 - 2. Advance Tabco.
 - 3. Just.
- J. Disposers
 - 1. In-sink-erator.
 - 2. Hobart.
 - 3. Kitchen-Aid.
 - 4. Whirlpool.
- K. Valves
 - 1. Ames.
 - 2. Hayward.
 - 3. Apollo.
 - 4. Watts.
 - 5. ASCO.
 - 6. Stockham.
 - 7. Febco.
- L. Flush Valve Water Closets
 - 1. Kohler.
 - 2. Gerber.
 - 3. Toto.
- M. Lavatories
 - 1. American Standard.
 - 2. Gerber.
 - 3. Toto.
 - 4. Kohler.
 - 5. Zurn.
- N. Urinals
 - 1. American Standard.
 - 2. Gerber.
 - 3. Toto.
- O. Fixture Carriers
 - 1. J. R. Smith.
 - 2. Josam.
 - 3. Watts.
 - 4. Zurn.
- P. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 PLUMBING FIXTURES AND TRIM

- A. All fixtures shall be vitreous china, acid resisting enamel cast iron or stainless steel as specified complete with brass piping, fittings, supplies, stops, flush pipes, trim and brackets. Exposed brass piping and fittings shall be chrome plated.
- B. Where manufacturer's numbers for a complete assembly are called for, such assembly shall be modified as specified in this section.
- C. Wherever reasonably possible, all fixtures, all trim, all faucets, etc. on the project shall be of the same manufacturer's products. A "mixture" of brands for the contractor's convenience will not be permitted.
- D. Fixtures shall have water, drain, waste, soil, vent, and other connections as called for. Each water connection fixture shall have an air gap or vacuum breaker as required by local and state departments of health. Water connection sizes are minimum and must be increased to correspond to manufacturer's standards.

- E. Carriers for wall hung fixtures shall be selected for the particular fixture, piping arrangement and building conditions prevailing at each location.
- F. Where lavatories without legs are specified, each shall be supported on a chair type carrier with concealed arms.
- G. Special sinks, where wall hung, shall have equivalent chair carriers specifically designed for the fixture.

2.03 FIXTURE CARRIERS:

- A. Lavatories, urinals, and wall-mounted water closets shall be supported by floor-mounted carriers. Urinal carriers may be omitted where urinals are mounted on masonry walls 6" thick or more.
- B. Urinal carriers shall be Zurn Z1217 or approved equal, selected to fit the fixture.
- C. Lavatory carriers shall be Zurn Z1230 (floor mounted) or approved equal, selected to match fixtures.
- D. Wall-mounted water closets shall have Zurn Z1212 carriers as required by mounting height. For narrow-wall installations, use Zurn – Z1280 or similar, as required by the installation. Contractor shall verify the wall thickness and submit and furnish the carrier to suit.

2.04 WATER CLOSET-HANDICAPPED

- A. For water closets in stalls or rooms intended to be accessible to the handicapped, the ADA requires the flush handle to be located on the wide side of the stall. For tank-type water closets, furnish units with the handle on the proper side of the tank. For flush valve water closets, install the flush valve with the handle on the proper side.

PART 3 - EXECUTION

3.01 PLUMBING FIXTURES AND TRIM

- A. All fixtures shall be set firm and true, connected to all piping services ready for use. Fixtures shall be installed per manufacturers recommendations.
- B. Fixture carriers shall be installed per the manufacturer's instructions, and shall be securely attached to floor and wall construction. Adjustments for fixture height shall be set and checked before installation of wall finish materials.
- C. Fixtures intended for accessibility to the handicapped or to meet ADA requirements shall be installed at recommended heights and with appropriate clearances. Report any conflicts or discrepancies to the Engineer.
- D. Sinks and lavatories for handicapped access shall be installed with offset tailpieces and insulated traps.
- E. Fixtures that may present a scalding hazard to users of the building shall be protected by a thermostatic mixing valve or other approved anti-scald device.

3.02 OWNER FURNISHED EQUIPMENT

- A. Provide rough-ins and final connections to all Owner furnished equipment including shut off valves, piping, traps, etc. necessary to connect up equipment after it has be installed in place.
- B. Install all faucets, sinks drains, tailpieces, overflows, traps, etc. furnished loose with all Owner furnished equipment.
- C. All exposed piping readily visible for Owner furnished equipment shall be chrome plated red brass pipe and fittings. Braces for support of exposed piping shall be chrome plated.
- D. Pending installation of Owner furnished equipment, all service lines shall be suitably capped, plugged and protected. All water lines shall be valved.
- E. Furnish vacuum breakers, pressure regulators solenoid valves, traps, piping, etc. as required for installation of equipment.

END OF SECTION 22 40 00

SECTION 23 05 93 - TESTING, ADJUSTING, & BALANCING OF HVAC SYSTEMS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 4. General Conditions. |
| 2. General Provisions of the Contract. | 5. Supplementary Conditions. |
| 3. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. The HVAC systems shall be tested and balanced by an independent agency under contract directly with the General Contractor.
- B. The HVAC Contractor shall inform the General Contractor in writing that this work is under the General Contractor's responsibility.
- C. If the HVAC Contractor fails to inform the General Contractor, then the HVAC Contractor will be charged for the cost of this work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS (NEBB OR AABC CERTIFIED)

- A. This Agency shall be certified by the National Environmental Balancing Bureau (NEBB) or by the American Air Balance Council (AABC). Six (6) copies or one electronic copy of the final balancing report shall be submitted on applicable NEBB Reporting Forms for review. Each individual final reporting form submitted shall bear the name of the person who recorded the data and the seal of the supervisor of the performing firm. Identification of all types of instruments used and their last dates of calibration shall be submitted with the final report.
- B. The independent air/hydronic testing and balancing agency (TAB) shall perform the balancing and testing of the HVAC in accordance with the procedures of AABC or NEBB to analyze, balance, adjust and test air and water moving equipment, air and water distribution system including kitchen exhaust hood system.
- C. The HVAC Contractor shall put all heating, ventilating and air conditioning systems and equipment into operation and shall continue the operation of same during each working day of testing and balance and shall place the automatic temperature control system in satisfactory operation before the TAB agency shall begin work.
- D. The first responsibility of the test and balance contractor is to test all functions of the HVAC systems, including the control system and night setback system, to assure that they function as designed. A report of such testing shall be included.
- E. If self-balancing valves are used for each coil, balancing measurements of each valve are not required. One typical valve of each size and each flow rating shall be measured and the results reported. Water flow at each pump shall be reported. Report pump flows operating in tandem (where applicable).
- G. Prior to the final acceptance of the HVAC system by the Engineer, the HVAC Contractor shall allow the TAB agency to schedule this work in cooperation with other trades involved and comply with the completion date of the project.
- H. The HVAC Contractor shall make available to the TAB agency a complete copy of shop drawing submittal data on mechanical equipment including performance curves (fans and pumps, chillers, air distribution devices, etc.) necessary to test and balance the HVAC system.
- I. The HVAC Contractor shall schedule the following necessary personnel:
1. Automatic Temperature Control Manufacturer's Service Representative to set adjustments of automatic operated damper and devices to operate as specified, and/or noted, including setting of all controls for

- proper calibrations.
2. Mechanics - To operate, adjust, replace or repair the HVAC equipment that is found requiring any change/replacement in the pulleys, belts, dampers, valves, etc., of Contractors furnished and installed equipment.
 3. Electrician - To assist in any problems resulting from any of the power or control wiring installation, including replacement of starters, and heater elements.
 4. The HVAC Contractor shall make any changes in pulleys, belts and dampers or the addition of dampers as required for correct balance of the system as recommended by TAB agency, at no cost to Owner.
- J. The HVAC Contractor shall make all necessary corrections within 48 hours upon notification of TAB agency of the deficiencies requiring adjustment, (piece-meal correction is not acceptable) and within 10 working days for items that require replacement or installation.
- K. The HVAC Contractor shall leave all strainers clean and all air filters replaced prior to the start of testing and balancing activity.
- L. If the Contractor had scheduled the TAB agency to perform the work and the HVAC systems are not ready to be tested and balanced, any additional cost required in delay of the TAB work shall be at the HVAC Contractor's expense.

END OF SECTION 23 05 93

SECTION 23 09 23 - DIGITAL HVAC CONTROLS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Solicitation Documents.
 4. General Conditions.
 5. Architectural Division.

1.02 WORK INCLUDES

- A. This Section includes all specialties, and accessories for an electric, electronic, direct digital control system within the building.
- B. Provide as herein specified, a complete electric, electronic, direct digital temperature control system. The control system shall be installed by competent control mechanics and electricians regularly employed by the manufacturer of the control equipment. All control equipment shall be the product of one manufacturer. The control system shall consist of all thermostats, temperature transmitters, direct digital controllers, automatic dampers, damper operators, switches, control panels and other accessory equipment along with a complete system of electrical wiring to fill the intent of the specification and provide for a complete and operable system. All control equipment shall be fully proportioning, except as otherwise noted. All wiring and conduit shall comply with requirements of Division 26.
- C. The contractor shall furnish and install controls as indicated on the drawings and specified herein for the purpose of automatically controlling each HVAC system. This contractor shall acquaint himself with the desired sequence of control, and it shall be his responsibility to bring about this result. It is required that all controls on this project be furnished and installed by a controls subcontractor.
- D. The control system shall be installed by an experienced controls subcontractor who is regularly engaged in installations of similar size and description in his normal course of business, and has existing installations that have been fully operational for a period of not less than three years. Proof of such installations shall be required prior to contract approval by the Owner. The Installer shall have an established working relationship with the Control System Manufacturer of not less than three years. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request. The installer shall have an office within 100 miles of the project site and provide 24 hour response in the event of a customer call.
- E. Warranty
1. Labor & materials for control system specified shall be warranted free from defects for a period of twenty-four (24) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.
 2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of warranty.
 3. Operator workstation software, project specific software, graphics, database, and firmware updates shall be provided to the Owner at no charge during the warranty period. Written authorization by Owner must, however, be granted prior to the installation of such changes.
 4. The system provider shall provide a web-accessible Users Network to give the Owner access to question/answer forum, graphics library, user tips, upgrades, and training schedules.

1.03 RELATED WORK

- A. Section 20 03 00 - "MATERIALS AND METHODS".

1.04 SUBMITTALS

- A. Prior to any fabrication, ordering, or installation work, complete submittals and shop drawings for the control system shall be made. The submittal shall include the following:
1. Control wiring and program logic diagrams (CAD drawings).
 2. Complete manufacturer's data sheet on each control device to be used.
 3. Pictorial representation of each room sensor or control device to be installed in the occupied spaces.

1.05 SYSTEM DESCRIPTION

- A. The system shall be electric, electronic, direct digital as specified in the Sequences of Operation and indicated on the input/output interface summaries. Exact duplication of the arrangements shown in the diagram is not required. System design is the responsibility of the controls subcontractor, and he shall arrange the system to accomplish the objectives of control which are indicated by the diagrams and the sequences of operation herein.
- B. The system shall be provided with internal or external battery power or other suitable means to prevent loss of programming or setpoints during power outages to the building. The system shall be capable of experiencing a loss of power up to 96 hours in duration without requiring service for restarting or reprogramming. Restarting shall be fully automatic.

1.06 ELECTRIC WIRING

- A. Control wiring, regardless of voltage, is the responsibility of the controls subcontractor, including all conduit and outlet boxes for controls. All line voltage and low voltage control wiring shall be installed in accordance with the requirements of the Electrical Specifications. No control wiring shall be installed inside any duct. In general, corridor ceiling spaces on this project are considered to be air handling.
- B. Control wiring which operates at more than 24 volts nominal shall be copper wire installed in EMT conduit. Low voltage control wiring in accessible locations above ceilings may be jacketed plenum cable. No wire smaller than 18 gauge shall be used. Such wiring shall be neatly strapped in place with plastic wire ties. Attach to top chords of bar joists or other framing members or top rows of joist bridging. Do not attach to or lay on ceilings or bottom chords of bar joists. Low voltage wiring where exposed to view shall be installed in EMT conduit.
- C. Outlet boxes or other recessed enclosures for control wiring shall be installed as indicated and the contractor shall assure that the proper boxes are available in time to avoid delaying the masonry work or other trades.
- D. Line voltage wiring which provides power to the main motor of any piece of HVAC equipment, including manual switch wiring, is considered power wiring and is specified under the electrical work. Circuits to motorized dampers are control wiring.
- E. Control diagrams are the responsibility of the HVAC contractor. At the completion of the job, all diagrams shall be provided to the Owner along with the equipment operating and maintenance instructions, see Section 20 01 00 - "GENERAL PROVISIONS."
- F. Where control wiring must be routed in masonry walls (such as to thermostats) it shall be installed in conduit. Assure that conduit and boxes are placed in time to avoid delaying masonry work.
- G. Power for control devices and panels shall originate within the equipment being controlled. The control contract shall in all cases provide for connection to such power, and provide for any necessary control circuit transformer. No separate electrical circuits will be provided for control equipment or panels by the electrical contractor except as may be specifically shown on the drawings.

PART 2 - DIGITAL ELECTRONIC SYSTEM

2.01 ACCEPTABLE MANUFACTURERS

- A. Trane (In FEMA Building)
- B. Johnson Metasys (In Main Building)
- C. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 CONTROL DEVICES

- A. Thermostats, room sensors, temperature controllers, damper motors, relays, switches, and all other control devices shall be provided as required to achieve the control sequences called for. All control system elements require the engineer's approval of submittals. All equipment and devices used shall be of first quality, the best offered by the control system being used.
- B. Provide guards for thermostats as noted on the drawings.

2.03 PRODUCT DETERMINATION AND SUBSTITUTION

- A. The above listing of mechanical equipment has been determined by the Engineer as meeting the requirements of the construction documents, and competent maintenance and repair service has been determined to be available in the locale of the project. The determination of availability of this equipment within the time required for contract performance is the responsibility of the contractor.
- B. Listed substitutions may be made without written prior approval. In all cases, the substituted item shall be, in the judgment of the Engineer, equal to the specified item in all aspects, including efficiency, actual capacity rating, controls, accessories, design concept, warranty, etc..

2.04 GENERAL REQUIREMENTS

- A. The electronic control system shall include but not be limited to the following components:
 - 1. The Operator Interface shall consist of hardware and software that allows full user monitoring and adjustment of system parameters.
 - 2. Controllers shall manage the Energy and building Management capabilities of the automation system as well as facilitate remote communications and central monitoring.
 - 3. The Data Communications capability shall allow data to be shared between the various controllers in the system.
 - 4. The system software shall include system software for global (system-wide) application functions, application software for distributed controllers, and operator interface software.
 - 5. End (terminal) devices such as sensors, damper actuators, valves, and relays (dampers are specified elsewhere on the drawings).
- B. The failure of any single component shall not interrupt the control strategies of other operational devices. System expansion shall be through the addition of end devices, controllers, and other devices described in this specification.
- C. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.
- D. Operating System. Furnish a commercially available, concurrent multi-tasking operating system. The operating system shall also support the use of other common software applications that operate under DOS or Microsoft Windows.
- E. Communications. Each Building Controller shall reside on a BACnet inter-network using the ISO 8802-3 (Ethernet) or ARCNET (ASTM 878.1) Physical/Data Link layer protocol. Each Building Controller shall also perform routing to a network of Custom Application and Application Specific Controllers.

2.05 OPERATOR INTERFACE

- A. An interface shall be provided to allow the building operator to view and acknowledge alarms, access/edit system database information, view system displays and reports, and customize the system as described in this specification. Furnish a PC based work-station as shown on the system drawings. Each of these work-stations shall be able to access all information in the system. These work-stations shall reside on the same high speed network as the building controllers, and also be able to dial into the system. Work-station information access shall use the BACnet Protocol. Communication shall use the ISO 8802-3 (Ethernet) or ARCNET (ASTM 878.1) Physical/Data Link layer protocol. Remote communications shall use the BACnet Point to Point Physical/Data Link Layer Protocol. Furnish IBM compatible PCs as shown on the drawings. A two button mouse will also be provided. Furnish all required serial, parallel, and network communication ports, and all cables for proper system operation. The PC shall have a minimum of a 15" monitor.
- B. Telephone Modem - An autodial type telephone modem and associated cables shall be provided. The modem shall transmit at a minimum of 9600 BAUD and communicate over voice grade telephone lines.
- C. Printer - A remote printer and required cables shall be provided. It shall be capable of 200 characters per second operation and be compatible with the personal computer workstations.

2.06 GRAPHIC REQUIREMENTS (MINIMUM)

- A. Color graphics shall be used to illustrate all functions of the control system's operation, to report alarm conditions, and to display and reset setpoints and schedules. The color graphics package shall provide a simplified plan of the building for display purposes.
- B. Dynamic/interactive color graphics software shall allow the display of dynamic real-time point data from panels on operator-created color graphic displays. Displays shall be created with the use of a mouse, digitizer, or joystick, and be capable of displaying up to 256 colors simultaneously.
- C. The package shall be capable of presenting dynamic information in the form of descriptors, values, and/or symbols. Dynamic points shall be located on the graphic by using either a pointing device or a keyboard.
- D. The package shall allow the use of a mouse to move from one graphics to another by pointing and clicking with the mouse to a "target" display.
- E. The graphics interface must provide the ability to manually override points.
- F. Notification of alarms from panels must be provided on the graphic displays while the system is in the graphics mode.
 - 1. System Graphics. The Operator Workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on line. An operator with the proper password level shall be able to add, delete, or change dynamic points on a graphic. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the point.
 - 2. Standard Graphics. Provide graphics for each major piece of equipment in the building. This includes each heat exchanger, system loop pump, exhaust fans, chiller, air handling unit, VAV terminal, fan coil unit, etc. These standard graphics shall show all points as specified or shown on the input/output interface summary.
 - 3. Custom Graphics. The system shall have custom graphics provided as detailed on the system drawings. Custom graphic files shall be created with the use of a PC graphics package furnished with the system. The package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF, GEM, or DXF file. The package shall also provide the capability of capturing or converting graphics from other programs such as Designer, or AutoCad.
 - 4. Graphics Library. Furnish a complete library of common HVAC equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library shall also include symbols for other equipment including fans, pumps, valves, piping, and ductwork. The library shall be furnished in a file format compatible with the graphics program.
 - 5. Alarm Reactions. The operator shall be able to determine what action if any are to be taken, by object, during an alarm. Actions shall include logging, printing, starting programs, displaying messages, providing audible annunciation or displaying specific system graphics. Each of these actions shall be configurable by

workstation and time of day. The system shall provide 3 minimum levels of alarm priority. An object in alarm that has not been acknowledged within an operator specified time period shall be moved to a higher level of priority and follow the actions for that level.

6. Scheduling. A complete graphically based editor for the scheduling application shall be provided at the workstation. Provide an easy to use method of selecting the desired schedule and month. This shall consist of a "month at a glance" calendar for each schedule. Exception schedules and holidays should be shown clearly on the calendar in contrasting colors. Selecting a day on the calendar with the mouse should display the schedule for that day. Provide an easy to use method for allowing several related objects to follow a schedule. The start and stop times for each object shall be adjustable off of this master schedule.
7. Provide the capability for seasonal schedules that will be automatically executed during user defined periods. This shall enable the operator to have a group of equipment in discrete Summer and Winter schedules. Each seasonal schedule shall only be active during the operator specified time periods. The schedule shall be available for viewing and editing even when not active. The operator viewing a schedule shall be able to see graphically whether the schedule is active or inactive for up to a year in advance.
8. An operator with proper password level shall be able to modify the schedule. Schedules shall be able to be easily copied to other objects and/or dates.

2.07 SYSTEM CONTROLLERS

- A. The Building Automation System shall be composed of one or more independent, stand-alone, microprocessor based System Controllers to manage the global strategies described in Application software section. Sufficient capacity shall be built in to allow a 40% expansion of the number of application-specific controllers and custom applications controllers.
- B. The System Application Controller shall have ample memory to support its operating system, database, and programming requirements.
- C. The operating system of the System Application Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
- D. Data shall automatically be shared between System Controllers when they are networked together.
- E. The database and custom programming routines of remote System Controllers shall be editable from the single operator station.
- F. The System Applications Controller shall have the capability of being remotely monitored over the telephone modem. Additional capabilities shall include automatically dialing out alarms, gathering alarms, reports and logs, programming and downloading databases.
- G. The controller shall continually check the status of all processor and memory circuits. If failure is detected, the controller shall:
 1. Assume a predetermined failure mode.
 2. Emit an alarm, and print a notice of the alarm.
 3. Identify the failed component at the operator interface workstation.
- H. The System Controller (located in the mechanical room) may incorporate provisions for control of pumps, etc. in that area, or a separate controller for that purpose may be used.

2.08 APPLICATION-SPECIFIC CONTROLLERS

- A. Application-Specific Controllers shall be stand-alone, microprocessor based Direct Digital Controllers with sufficient memory to handle its operating system, database and programming requirements.
- B. The Application-Specific Controller shall be pre-programmed, tested, and factory mounted on the mechanical equipment to ensure reliability. Where factory mounting is not possible, the controllers shall be factory programmed and tested prior to shipment to the job site.
- C. Control units shall be mounted on the HVAC equipment and fully wired prior to hanging the equipment in the ceilings space. Mounting and wiring in the ceiling space will not be permitted. Preferably the units should be mounted and wired at the equipment manufacturer's plant prior to shipment. If this cannot be done, they shall be mounted and wired at the HVAC contractor's shop or at a central, well-organized temporary work location inside the building.
- D. Each controller shall be clearly labeled as to controller type, where it is to be installed, and software address (if

applicable). The controller shall be fully tested upon installation to ensure that it is properly matched to the equipment it is controlling.

- E. The controller shall communicate with other devices on the communication network and be fully integrated with the other system components.

2.09 TERMINAL DEVICES

A. Damper Operators.

1. Damper operators shall be shaft-mounted, electronic, low voltage (24VAC) and shall be properly sized so as to stroke the damper smoothly and efficiently throughout its range. Actuator response shall be linear in response to sensed load. Direct rotary connections to damper shafts shall be utilized.

B. Valve Operators.

1. Valve operators shall be shaft-mounted, electronic, low voltage (24VAC) and shall be properly sized so as to stroke the valve smoothly and efficiently throughout its range. Actuator response shall be linear in response to sensed load. Direct rotary connections to valve shafts shall be utilized. Upon a power loss valve operator shall stroke the valve fully open, unless required otherwise for failsafe protection of equipment.

C. Temperature Sensors.

1. Temperature sensors shall be Resistance Temperature Detector (RTD) or Thermistor as dictated by the requirements of this specification.
2. Duct sensors shall be rigid or averaging as specified in the sequence of operations. Averaging sensors shall be a minimum of 5 feet in length.
3. Immersion sensors shall be provided with a separable stainless steel well.
4. Space sensors shall be equipped with setpoint adjustment, software programmable for deadband, set at 3°F. An override switch shall be provided for night setback override.
5. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.1 C [0.2 F].

D. Humidity Sensors.

1. Duct and room sensors shall have a sensing range of 20% to 80% with accuracy of ±5% R.H.
2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% R.H. It shall be suitable for ambient conditions of -40 C to 75 C [-40 F to 170 F].
4. Humidity sensor's drift shall not exceed 1% of full scale per year.

E. Static Pressure Sensors.

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.
2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.
3. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.
4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

F. Low Limit Thermostats.

1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section.
2. Low limit shall be manual reset only.

G. Indoor Air Quality Sensors.

1. Indoor air quality sensors shall measure both total percentage VOCs and CO2 in PPM. Sensors shall be duct or space mounted.

H. Flow Switches.

1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
2. Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA Type 1 enclosure unless otherwise specified:

3. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA Type 1 enclosure, with scale range and differential suitable for intended application, or as specified.
 4. Current sensing relays may be used for flow sensing or terminal devices.
- I. Relays.
1. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.
 2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA Type 1 enclosure when not installed in local control panel.
- J. Transformers and Power Supplies.
1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
 2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
 3. Unit shall operate between 0 C and 50 C.
 4. Unit shall be UL recognized.
- K. Current Switches.
1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.
- L. Duct Smoke Detectors.
1. Duct smoke detectors are specified as part of the building's fire alarm system.

2.10 OPERATOR INTERFACE SOFTWARE

- A. System Security.
1. User access shall be secured using individual security passwords for a minimum of six users.
 2. Passwords shall have at least two levels of user access with data entry restrictions being assignable by password.
 3. User log-on/log-off attempts shall be recorded.
 4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
- B. Alarms.
1. The system shall provide audio, visual, contact closure, and remote telephone annunciation for:

a. Remote equipment failure	b. Program failure
c. Equipment run time	d. Electronic failure
e. Number of start/stops	f. Sensor failure
 2. When an alarm state is detected, the alarm shall automatically be stored and the user notified by showing the alarm message, sounding an audible tone, and flashing an alarm message on the CRT.
 3. An after hours alarm processing function shall transfer the alarm message to an alternate location equipped with a terminal device and an auto-answer modem. The telephone number, and the time of day to start and stop after hours processing shall be user designated.

2.11 COMMUNICATIONS

- A. A communications utility shall allow stand-alone System Controllers to communicate with remote operator stations over the internet.
1. Remote Alarming/Reporting.
 - a. Controllers shall automatically call operator stations to report alarms, and upload historical data and reports.
 - b. In the event that the controller is unable to connect with the remote station, it shall continue to attempt communication on a predetermined interval until communication is successful. The capability shall exist to automatically switch to a backup phone number in the event communication is unsuccessful

- with the first number.
- c. A capability shall also exist to allow alarms to be directed to separate printer, CRT, or Personal Computer during off hours.
- 2. Remote Operator Communications.
 - a. Operator shall be able to access remote System Controllers and gain access to the full control, reporting, and system modification capabilities described in this specification.
 - b. The operator shall remote buildings by selecting the user-definable name associated with the building.

PART 3 - EXECUTION

3.01 CONTROL DEVICES

- A. All thermostats, room sensors, override buttons, and other control devices which are adjustable by the occupants of the building, shall be mounted so as to meet ADA (Americans with Disabilities Act) accessibility requirements. Mount devices 48" AFF to the bottom of the device unless a conflict occurs. Where the 48" location is obstructed by a light switch, counter, or other item, the height may be increased to 54", but only in locations where the control can be operated by a "side reach" from a wheelchair. If this adjustment will not resolve the conflict, report it to the engineer for resolution.
- B. Transformers, control module, and motor interface devices shall be mounted on a plywood base adjacent to air handling unit.
- C. Install room thermostats furnished with duct coils and unit heaters, wire, test and calibrate controls.

3.02 CONTROL HARDWARE INSTALLATION

- A. Terminal control units shall be mounted on the HVAC equipment and fully wired prior to hanging the equipment. Mounting and wiring in the ceiling space will not be permitted. Preferably, the units should be mounted and wired at the manufacturer's plant prior to shipment. If this cannot be done, they shall be mounted and wired at the HVAC contractor's shop or at a central, well-organized temporary work location inside the building.
- B. Each terminal unit shall be checked to verify proper function prior to installation in the building.
- C. The complete control system shall be programmed and started in operation by its installers.
- D. After approximately 6 months use of the building, the controls subcontractor shall visit the building and check all functions of the controls, making any adjustments which may be made necessary by the change in seasons, and reviewing its operation with the Owner's representative.

3.03 TRAINING

- A. This contractor shall provide 3 copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the temperature control and Building Automation System supplied. This contractor shall instruct the owner's designated representatives in these procedures during the startup and test periods. The duration of the instruction shall be two four sessions at turnover of the Building Automation System to the owner. An additional four hour instruction session shall be scheduled 30 days after turnover of the system. An additional four hour instruction session shall be scheduled for 60 days after turnover of the system. One final four hour instruction session shall be scheduled for 180 days after system turnover. During the warranty period, this contractor shall provide consultation in programming, scheduling and operation by telephone at no additional charge to the owner. The contractor shall conduct a training session for the Owner's operating and maintenance personnel to familiarize them with the control system. This session shall be held after the system is fully operational. The session shall be video taped, and the tape given to the owner at the conclusion of the session.

3.04 EQUIPMENT LABELING

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".

3.05 FINAL ADJUSTMENT OF CONTROLS

A. See Section 20 02 00 - "Contract Close-out & Commissioning".

END OF SECTION 23 09 23

SECTION 23 11 23 - GAS PIPING SYSTEMS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Conditions.
 3. General Provisions of the Contract.
 4. Supplementary Conditions.
 5. Architectural Division.

1.02 WORK INCLUDES

- A. This Section includes piping, specialties, and accessories for gas systems within the building and outdoors.
B. Fees, permits and licenses; see Section 20 01 00, 1.02 "Work Includes".

1.03 RELATED WORK

- A. Section 20 03 00 - "MATERIALS AND METHODS"
B. Section 20 04 00 - "Testing Piping Systems."
C. Section - "Painting"

1.04 SUBMITTALS

- A. Submit the following according to Conditions of Contract, Architectural Division, and Division 20 01 00, General Provisions.
B. Product data for each type of gas specialty and special-duty valve. Include pressure rating in psig, rated capacity in cu. ft. per hour (CFH), and settings of selected models.
C. Maintenance data for gas specialties and special-duty valves for inclusion in Operating and Maintenance Manuals specified in Architectural Division Section "PROJECT CLOSEOUT."
D. Test reports specified in "Field Quality Control" Article in Part 3.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 54 "National Fuel Gas Code" for gas piping materials and components; installations; and inspection, testing, and purging.
B. Comply with the International Mechanical Code, latest edition, for all fuel gas piping installation.
C. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
D. Listing and Labeling: Provide equipment and accessories that are listed and labeled.

1.06 DEFINITIONS

- A. Low-Pressure Gas Piping System: Operating at pressure of 7" W.C. or ½ psi, or as indicated on drawings.
B. Gas Service:
 1. Existing gas service remains.

C. Gas Piping System: Pipe within the building that conveys gas from point of delivery to points of usage. Piping includes dielectric fitting and gas valve immediately downstream from point of delivery.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Gas Pressure Regulators
1. American Meter Co.
 2. Jordan Valve Div., Richards Industries, Inc.
 3. Fisher Controls.
 4. Lancaster by National Meter Parts, Inc.

- 5. Gas Energy, Inc., Subsid., Brooklyn Union Gas.
- 6. Maxitrol Co.
- B. Low-Pressure Gas Stops
 - 1. Hammond Valve Corp.
 - 2. Lancaster by National Meter Parts, Inc.
 - 3. Jomar International, Ltd.
 - 4. Rockford-Eclipse Div., Eclipse, Inc.
- C. Gas Valves, 2 Inches and Smaller
 - 1. Homestead by Olson Technologies, Inc.
 - 2. Mueller Co., A Grinnell Co.
 - 3. Lancaster by National Meter Parts, Inc.
 - 4. Mueller Steam Specialty Div., Core Industries, Inc.
 - 5. Lunkenheimer Co.
 - 6. Nordstrum Valves, Inc.
 - 7. Milliken Valve Co., Inc.
 - 8. Rockford-Eclipse Div., Eclipse, Inc.
- D. CSST (Corrugated stainless steel tubing)
 - 1. Titeflex.
- E. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 PIPES AND TUBES

- A. Refer to "Pipe Applications" Article in Part 3 for identification of systems where the following materials are used.
- B. Steel Pipe: ASTM A 53, Type E, Electric-Resistance Welded or Type S, Seamless, Grade B, Schedule 40, black.
- C. Plastic Pipe: ASTM D-2513, polyethylene pipe, SR-11, labeled for gas system use.
- D. CSST: Corrugated stainless steel tubing with polyethylene jacketing; 304 stainless steel.

2.03 PIPE AND TUBE FITTINGS

- A. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threads conforming to ASME B1.20.1.
- B. Unions: ASME B16.39, Class 150, black malleable iron; female pattern; brass-to-iron seat; ground joint.
- C. Steel Fittings: ASME B16.9, wrought steel, butt-welding type; and ASME B16.11, forged steel.
- D. Transition Fittings: Type, material, and end connections to match piping being joined.
- E. Underground Transition Risers: Schedule 40 steel epoxy coated casing, ASTM D2513.
- F. CSST Mechanical Fittings: Type, material, and end connections to match piping being joined.

2.04 JOINING MATERIALS

- A. Common Joining Materials: Refer to Section 20 03 00 - "MATERIALS AND METHODS" for joining materials not included in this Section.

2.05 VALVES

- A. Manual Valves: Conform to standards listed, or where appropriate, valves according to ANSI Z21.15 and ANSI Z21.15a.
- B. Low-Pressure Gas Stops, 2 Inches and Smaller: AGA- certified design for 2 psig or less gas, with AGA stamp, plug or ball type, bronze body and bronze plug or chrome plated brass ball. Include flat head, square head, or lever handle and threaded ends.
- C. Gas Valves, 2- ½ Inches and Larger: MSS SP-78, Class 125 or 175 WOG, lubricated plug type, semisteel body, wrench operated, with flanged ends.

2.06 PIPING SPECIALTIES

- A. Gas Pressure Regulators: comply with ANSI Z21.18. For appliance regulators or ANSI/U.L. 144 for second-stage regulators. (This applies only to regulators furnished and installed as part of the project, and not regulations furnished by others).
- B. Flexible Connectors: ANSI Z21.24 or ANSI Z21.24a, copper alloy.

PART 3 - PRODUCTS

3.01 PREPARATION

- A. Precautions: Close equipment shutoff valves before turning off gas to the premises or section of piping. Perform leakage test as specified in Section 20 02 00 - "Contract, Closeout & Commissioning" "Field Quality Control" Article to determine that all equipment is turned off in the piping section to be affected.
- B. Comply with NFPA 54 "Prevention of Accidental Ignition."

3.02 SERVICE ENTRANCE PIPING

- A. Extend gas piping and connect to the gas service piping in location and size indicated for gas service entrance to building.

3.03 TESTING PIPING SYSTEMS

- A. See section 20 04 00 "Testing Piping Systems" for required pressure tests.

3.04 PIPE APPLICATIONS

- A. Flanges, unions, transition and special fittings, and valves with pressure ratings same or higher than system pressure rating may be used in applications below, except where specified otherwise.
- B. Low-Pressure (½ PSI or less) Gas Systems, above Ground within or outside Building: Use the following:
 - 1. 2 Inches and Smaller: Steel pipe, malleable-iron, threaded fittings, and threaded joints.
 - 2. 2-1/2 Inches and Larger: Steel pipe, butt-welding fittings, and welded joints.
- C. Low-Pressure (½ PSI or less) gas systems, below ground within the buildings: Use the following:
 - 1. 1 inch and smaller: CSST tubing inside a schedule 40 PVC plastic sleeve.
 - 2. 1 ¼" and larger: polyethylene, ASTM D2513.
- D. Medium pressure (greater than ½ PSI up to 10 PSI) Gas Systems, Below Ground outside the buildings:
 - 1. 1/2 " and larger: Polyethylene, ASTM D2513.
- E. Medium pressure (greater than ½ PSI up to 10 PSI) gas systems above ground within the building and/or on the roof:
 - 1. Steel pipe, butt-welding fittings, welded joints

3.05 VALVE APPLICATIONS

- A. Use low-pressure gas stops, tapered plug or ball type, for shutoff to appliances with 2-inch or smaller low-pressure gas supply.
- B. Use gas valves for shutoff to appliances. Where the appliance input exceeds one million BTUH, use a lubricated plug valve.
- C. Use gas valves of sizes indicated for other gas shut-off applications where indicated.

3.06 JOINT CONSTRUCTION

- A. For steel pipe, refer to Section 20 03 00 - "MATERIALS AND METHODS" for basic piping joint construction.
- B. Use materials suitable for gas service.
- C. Joints and connections in underground polyethylene gas piping shall be made by butt-fused heat fusion methods, only by qualified personnel.

3.07 PIPING INSTALLATIONS

- A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for basic piping installation requirements.
- B. Above-Ceiling Locations: Gas piping may be installed in accessible above ceiling spaces (subject to approval of the authority having jurisdiction), whether or not such spaces are used as a plenum. Do not locate valves or unions in such spaces.
 - 1. Prohibited Locations: Do not install gas piping in or through circulating air ducts, chimneys or gas vents (flues), or ducts.

2. Concealed locations: Gas piping may be installed in concealed (inaccessible) locations as permitted by the International Mechanical Code only if all joints in the piping are welded.
- C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of gas meters. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.
 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
 - D. Install gas piping at a uniform grade of ¼ inch in 15 feet, upward toward risers. Install piping upward from the service point to equipment.
 - E. Connect branch piping from top or side (not bottom) of horizontal piping.
 - F. Install unions in pipes 2 inches and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
 - G. Anchor piping to ensure proper direction of piping expansion and contraction. Install expansion joints, expansion loops, and pipe guides as indicated.
 - H. Install vent of gas pressure regulators pointing down, in accordance with manufacturer's instructions.
 - I. All gas piping installed outdoors shall be painted with rust-resistant paint to prevent rusting. See Section 09900 for painting requirements

3.08 HANGER AND SUPPORT INSTALLATION

- A. Refer to Section 20 03 00 - "MATERIALS AND METHODS" for hanger and support devices.
- B. Install hangers for horizontal piping at 10' on centers or otherwise as called for on the drawings.
- C. Do Not support gas piping by extending it to stand on the floor.

3.09 VALVE INSTALLATION

- A. Install valves in accessible locations, protected from physical damage.
- B. Install a gas valve upstream of each gas pressure regulator.

3.10 CONNECTIONS

- A. Install gas piping near gas-utilizing equipment and appliances so as to allow servicing and maintenance.
- B. Connect gas piping to gas-utilizing equipment and appliances with shutoff valves and unions. Make connections downstream of valves and unions, with flexible connectors where indicated.

3.11 TERMINAL EQUIPMENT CONNECTIONS

- A. Install a gas valve upstream and within 6 feet of each gas-utilizing appliance. Install a union or flanged connection downstream from the valve to permit removal of controls.
- B. Sediment Traps: Install as described above, as close as practical to gas appliance inlets, downstream of the shut-off valve for the appliance.

3.12 ELECTRICAL BONDING AND GROUNDING

- A. Install above ground portions of gas piping systems that are upstream from equipment shutoff valves, electrically continuous and bonded to a grounding electrode according to NFPA 70.
- B. Do not use gas piping as a grounding electrode.

3.13 FIELD QUALITY CONTROL

A. See Section 20 02 00 - "Contract Close-out & Commissioning".

3.14 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 23 11 23

SECTION 23 21 13 - HYDRONIC PIPING**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

A. The following shall apply to this Section:

- | | |
|--|------------------------------|
| 1. Drawings. | 4. General Conditions. |
| 2. General Provisions of the Contract. | 5. Supplementary Conditions. |
| 3. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

A. Provide all material as specified in this Section.

1.03 RELATED WORK

- | | |
|--|---|
| A. Section 20 03 00 – “MATERIALS AND METHODS”. | B. Section 22 07 19 – “PIPING INSULATION”. |
| C. Section 20 04 00 – “TESTING PIPING SYSTEMS”. | D. Section 23 21 23 – “HYDRONIC PUMPS”. |
| E. Section 20 05 00 – “VALVES”. | F. Section 23 75 00 – “AIR HANDLING EQUIPMENT”. |
| G. Section 23 05 93 – “TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS”. | |

1.04 SUBMITTALS

- A. Submit shop drawings in accordance with Section 20 01 00 - “GENERAL PROVISIONS” for the following devices:
- | | |
|-----------------------|---------------|
| 1. Pipe and fittings. | 3. Hose kits. |
| 2. Balancing valves. | |
- B. Submit certificates of compliance for pipe and fittings specified under this section.

1.05 QUALITY ASSURANCE

- A. Code ratings, labels or other data which are die-stamped or otherwise affixed to the surface of the piping shall be in easily visible location.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- | | |
|---|---------------------------------|
| A. Unions (in copper pipe 2 in. and smaller) | |
| 1. Anaconda. | 2. Mueller. |
| 3. Chase Brass. | |
| B. Flange Connections | |
| 1. Cranite. | 2. Garlock. |
| C. Balancing Valves | |
| 1. Autoflow (self-adj. type): Flow Design, Inc. Dallas, TX | |
| 2. Griswold (self-adj. Type): Griswold Controls, Irvine, CA | |
| D. Hose Kits | |
| 1. Autoflow, Flow Designs Inc. | 2. Griswold, Griswold Controls. |
| 3. Thermo Tech Inc. | |
| E. Gauges | |
| 1. Ashcroft. | 2. Marshalltown. |
| 3. Marsh. | 4. Miljoco |

- F. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 PIPING MATERIALS

- A. All piping and fittings shall be manufactured in the United States. Each length of pipe and each fitting shall be marked with the manufacturer's name or trademark and the specification code to which it conforms.

2.03 PIPE AND TUBE MATERIALS

- A. See Part 3 Article "Pipe and Fittings Applications", for the application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems:
3. See Section 23 23 00 – "REFRIGERANT PIPING" for all refrigerant piping materials.
 4. See Section 23 81 46 - "GROUND-SOURCE HEAT PUMP SYSTEMS" for ground-source heat pump piping.
 5. Hard Copper Tube: ASTM B 88, Types K, and L, water tube, drawn temper.
 4. Soft Copper Tube: ASTM B88, types K and L, water tube, annealed temper
 5. Poly (Vinyl Chloride) (PVC) Plastic, DWV Pipe: ASTM D 2665, Schedule 40, plain ends.
 6. Schedule 40 Black Steel: A53 ERW, Grade B.
 7. Schedule 10 Black Steel: A135 ERW or A795 ERW, Grade B.

2.04 PIPE AND TUBE FITTINGS

- A. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22.
- B. Copper Tube, Grooved-End Mechanical Fittings: ASTM B 75, copper tube and ASTM B 584 bronze castings.
- C. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.
1. Threaded Ends: Threads conforming to ASME B1.20.1.
- D. Mechanically Formed Outlets: Manufacturer's standard written procedure for forming tee-branch outlet from pipe and tube.
- E. Malleable-Iron Unions: ASME B16.39, Class 150 hexagonal stock, with ball-and-socket joint, metal-to-metal bronze seating surfaces, and female threaded ends having threads conforming to ASME B1.20.1.
- F. Malleable-Iron Threaded Fittings: ASME B16.39, Class 150, standard pattern, with threads conforming to ASME B1.20.1.
- G. Poly (Vinyl Chloride) (PVC) Plastic, DWV Pipe Fittings: ASTM D 2665, made to ASTM D 3311; socket-type; drain, waste, and vent pipe patterns.
- H. Poly (Vinyl Chloride) (PVC) Plastic, Schedule 40, Socket-Type Pipe Fittings: ASTM D 2466.

2.05 JOINING MATERIALS

- A. Solder, brazing, and welding filler metals are specified in Part 3 of this Section.
- B. Couplings for Grooved-End Copper Tube and Grooved- End Copper Fittings: ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing having copper-colored enamel finish, with synthetic-rubber gasket having central- cavity, pressure-responsive design and suitable for hot water, with ASTM A 183 carbon-steel bolts and nuts.
- C. Schedule 40 Black Steel Pipe and Fittings - 2" and Smaller: Screwed joints with malleable-iron threaded fittings.
- D. Schedule 40 Black Steel Pipe and Fittings - 2- 1/2" and Larger: Welded joints with standard weight welding fittings.

2.06 VALVES

- A. Refer to Section 20 05 00 – "VALVES" for globe, ball, butterfly, and check valves.

2.07 BALANCING VALVES

- A. Balancing valves are required where called for on drawings.
- B. Furnish and install balancing valves (BV) with the capacities and pressure differential characteristics as indicated on the drawings. All parts and products on the Balancing control valves shall be warranted for period of five years from date of original sale.
- C. Valves (BV) shall be installed on the following units unless otherwise noted on drawings:
 - 1. All VAV box coils where called for.
- D. All BV Valves shall be provided with a union at each end, a ball valve, pressure differential taps.
- E. Cast iron valve bodies shall be provided with inlet and outlet tappings suitable for connection of instruments for verification of flow rates, and shall be marked to show direction of flow. Valve bodies shall be rated for use at not less than 150% of system designed operating pressures.
- F. Provide a metal identification tag, with chain, for each installed valve. The tag to be marked with zone identification, valve model number and rated flow in GPM.

2.08 PRESSURE INDEPENDENT CONTROL VALVES

- A. Control Valves: Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of the piping system, unless otherwise indicated.
- B. Pressure Independent Control Valves
 - a. Manufacturers:
 - i. BELIMO AIRCONTROLS (USA), INC.
 - b. The modulating control valves shall be pressure independent.
 - c. The control valves shall accurately control the flow from 0 to 100% full rated flow with an equal percentage flow characteristic. The flow shall not vary more than +/- 5% due to system pressure fluctuations across the valve with a minimum of 5 PSID across the valve.
 - d. Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and TEFZEL characterizing disc.
 - e. Combination of actuator and valve shall provide a minimum close-off pressure rating of 200 PSID.
 - f. The control valve shall require no maintenance and shall not include replaceable cartridges.
 - g. All actuators shall be electronically programmed by use of a handheld programming device or external computer software. Programming using actuator mounted switches or multi-turn actuators are NOT acceptable. **Actuators for 3-wire floating (tri-state) on ½" – 1" pressure independent control valves shall fail in place and have a mechanical device inserted between the valve and the actuator for the adjustment of flow. Actuators shall be provided with an auxiliary switch to prove valve position.**
 - h. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory via a single screw on a four-way DIN mounting-base.
 - i. The control valve shall require no maintenance and shall not include replaceable cartridges.
 - j. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
 - k. The use of pressure independent valves piped in parallel to achieve the rated coil flow shall be permitted. Actuators shall be electronically programmed to permit sequencing the flow with a single control output point. The use of external devices to permit sequencing is NOT acceptable.

2.09 HOSE KITS

- A. Provide and install Hose kits equal to "Griswold", ½" thru 2" non-toxic synthetic polymer with braided stainless steel outer covering.
- B. Hose kits shall be installed on the following units (Where called for on drawings):
 - 1. VAV box coils.

2.10 PIPE SPECIALTIES

- A. Unions in copper pipe 2 in. and smaller shall be brass solder joint unions constructed for 150 psi working

- pressure.
- B. Unions in steel pipe 2 inch and smaller shall be screwed, malleable iron, brass to steel type (F.S. WW-U-531c Class 1) for 150 psi working pressure.
 - C. Unions 2 ½ in. in size and larger shall be companion flanges. (ANSI B16.1). Flanged unions shall be flanges over welding nipples welded into pipelines.
 - D. Flanges shall be forged steel flanges (ANSI B16.5) constructed for 150 psi. working pressure. Bolts for flanged joints shall be made of bolt steel and shall have clean cut threads with upset square heads and semi-flush hexagonal cold pressed nuts (F.S. WW-F406b).
 - E. Flange connections shall be made up with high pressure special type graphited 1/16 in. sheet packing; or rubber, for temperature up to 200F (F.S. HH-G-156 class A).
 - F. Dielectric unions suitable for dielectric service shall be provided at pipe connections between steel or cast iron piping and copper tubing.

2.11 PRESSURE GAUGES

- A. Ranges of gauges shall be two times indicated operating pressure or 5 PSIG above relief valve setting. Verify ranges on shop drawings.
- B. Gauges shall be 4 ½” dial gauges encased in an aluminum diecast housing with a threaded access cover and glass crystal. The gauge body shall be water and dust tight with back flange and ⅜” npt. connection.
- C. Movements shall be rotary geared stainless steel with Grade “A” phosphor bronze Bourdon tube rated from 30” vacuum to 1000 PSIG maximum. Accuracy shall be within 1% of the scale range.

PART 3 - EXECUTION

3.01 PIPE AND FITTINGS APPLICATIONS

- A. Use pipe, tube, fittings, and joining methods for piping systems according to the following applications:
 - 1. Exterior HVAC Piping Below Ground: Use the following:
 - a. Schedule 40 black steel pipe; standard weight fittings; welded joints. The complete pipe assembly shall be coated with a .70 mil (min. thk.) opaque yellow color plastic coating equal to “Republic X-true Coat”.
 - 2. HVAC Piping Above Ground: Use the following:
 - a. 2” and Smaller: Schedule 40 black steel pipe; malleable-iron threaded fittings; screwed joints.
 - b. Alternate 2” and Smaller: Hard copper tube, type “L”; wrought copper or cast-copper pressure fittings; copper unions; bronze flanges; and joints brazed with “SIL-FOS” brazing alloy. Joints made with 95/5 solder are allowable on fittings designed and approved by their manufacturer for use with soft solder. 50/50/ solder is not permitted.
 - c. 2 ½” and Larger: Schedule 40 black steel pipe; standard weight fittings; welded joints.
 - 3. HVAC Condensate Piping:
 - a. Horizontal condensate lines longer than 5 feet (such as in ceiling spaces) shall be 1 ½” Schedule 40 PVC DWV. Connections to units shall be ¾”, equipped with a trap.
 - b. Condensate lines which pass through return air plenum ceiling spaces shall be 1” type “L” hard-drawn copper in lieu of PVC as stated above.
 - c. Vertical condensate lines which are not downstream of larger piping shall be ¾” PVC.
 - d. Condensate lines which penetrate outside walls and spill to grade shall be hard-drawn copper tube, Type “L”.
- B. See also Section 22 07 19 for “Piping Insulation”.

3.02 JOINTING OF PIPING

- A. Threads shall be full and clean cut, and ends of pipe shall be reamed. When screwed joints are assembled, the male thread shall be thoroughly coated with appropriate thread compound to serve as a joint sealer and as a prime coat of paint for the exposed threads. (Teflon tape may be used at Contractor's option.) Care shall be taken to keep all other foreign matter from entering the interior of the piping. Each section of pipe and all fittings shall be carefully inspected for dirt, grease, or other foreign matter on the inside and where necessary

they shall be properly cleaned before assembly.

- B. Soldered or brazed joints made with fittings having pre-inserted rings of solder or brazing alloy shall have the tube and fittings cleaned bright and fluxed. The joint shall be heated sufficiently to make a tight connection. Tubes and fittings without such rings, shall be cleaned bright, fluxed and heated until the solder is drawn into the joint by capillarity and the connection is tight. Flux shall be water soluble binder flux. In potable water systems, the use of solder and flux exceeding 0.2 percent lead content is prohibited.

3.03 EXPANSION AND CONTRACTION

- A. Provisions shall be made for expansion and contraction in all piping. Piping shall be installed in a manner such that joints will not develop leaks. All expansion shall be taken up by swing-connections, and the Contractor shall be responsible for the installation of these connections whether or not they are shown on the Drawings with specific means for relieving expansion and contraction. Slip-type expansion joints shall not be used. Particular care must be exercised at branches on underground piping to allow free movement at branch connection to main.

3.04 INSTALLATION OF PIPING

- A. Piping shall be installed on long continuous lengths, with a minimum number of joints. Joints, where necessary shall be carefully made to insure against leakage.
- B. All piping shall be firmly supported using hangers, brackets and braces to prevent sagging and/or lateral movement. All hangers, brackets, and other supports shall be securely fastened to the construction as may be required and in a manner acceptable to the Engineer. All piping shall be installed to maintain maximum head room. Nothing shall be suspended from the roof deck.
- C. Arrangement of all piping shall be as shown on plans. It is especially necessary that all mains be installed with view to accessibility in case of repair and location of pipe lines and spacing between same shall be so made that there will be no conflict between pipe lines by the several trades.
- D. Contractor shall give careful consideration to clearances and locations of lines and type of fittings used to obtain these clearances. Provide maximum headroom in all cases. Piping shall be installed parallel to building walls and at a height so as not to obstruct any portion of a window, light fixture, doorway, pipe tunnel or passageway. Ascertain from the drawings heights of all suspended ceilings, size of all pipe shafts in which piping is to be concealed, and location and size of structural members in and adjacent to all pipe shafts.
- E. Where interferences develop in the field, Contractor shall offset or reroute piping as required to clear such interferences. In all cases consult architectural drawings for exact location of pipe spaces, ceiling heights, or other architectural details before installing piping.
- F. Under no circumstances shall the size of piping shown on the drawings be changed without written approval of the Engineer.
- G. Provide eccentric reducers where required for proper drainage or venting of horizontal pipe lines. Reducing fittings shall be used for all changes of pipe size and bushings shall not, under any circumstances, be used.
- H. Unions or flanges are to be installed on the equipment side of all valves in pipe connections from mains to equipment, to enable equipment to be drained and disconnected without necessitating the draining of mains.
- I. Valves must be arranged for easy access and be within easy reach and the piping shall be arranged to accomplish this.

3.05 CLEANING THE PIPING SYSTEMS

- A. Before pipe covering is applied and final tests are made, flush the water piping systems thoroughly to remove grit, sand, oil, welding slag, etc., for as long a time as is required to thoroughly clean the apparatus and piping. Make the required temporary connections for this purpose. Use tap water for flushing. Drain completely prior to installing the permanent heat-transfer fluid.
- B. Clean all permanent strainers in the system, and remove all temporary "start-up" strainers (such as at pumps) prior to installing the permanent heat-transfer fluid.
- C. Care must be taken not to get dirt, grease, dirty water, etc., upon the floors or walls. Any damage done shall be promptly repaired.
- D. After the period of these operations, any defects or damages that may have developed in the equipment and

apparatus as a result of the cleaning process or the operation of the system shall be made good, and the apparatus put in first class working order.

END OF SECTION 23 21 13

SECTION 23 21 23 - HYDRONIC PUMPS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Solicitation Documents.
 4. General Conditions.
 5. Supplementary Conditions.
 6. Architectural Division.

1.02 WORK INCLUDES

- A. This Section includes units and accessories listed below, complete with controls.
1. Pumps.

1.03 RELATED WORK

- A. Section 23 21 13 - "HYDRONIC PIPING".

1.04 SUBMITTALS

- A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:
1. Product data including weights and dimensions and data on features and components. Include plan and elevation views of units, minimum clearances, and data on ratings and capacities.
 2. Maintenance data for products for inclusion in "Operating and Maintenance Manual" specified in Division 01.
 3. Wiring diagrams from manufacturers detailing electrical requirements for power and control wiring for furnaces. Include ladder-type wiring diagrams for interlock and control wiring required for field installation. Differentiate between portions of wiring that are factory installed and portions that are to be field installed.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70, "National Electrical Code."
- B. NRTL Listing: Provide electrical components specified in this Section that are listed and labeled.
1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.06 DEFINITIONS

- A. Control Wiring: Wire, conduit, and miscellaneous materials for mounting and connecting electric control devices.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Pumps
1. Grundfoss.
 2. Peerless.
 3. Armstrong.
 4. Taco.
 5. Aurora.
 6. Bell & Gossett

- B. Pump Accessories
 - 1. Amber/Booth.
 - 2. Amtrol.
 - 3. Bell & Gossett.
- C. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 CONTROLS

- A. Include control components required for satisfactory operation of units and auxiliary equipment in all seasons, including:
 - 1. Control Transformer: 24V a.c. output, factory-installed and wired.
 - 2. Relays: As required to achieve specified operation.

2.03 FINISHES

- A. External Casing and Cabinets: Baked enamel over corrosion-resistant treated surface.

2.04 PRODUCT DETERMINATION AND SUBSTITUTION

- A. The above listing of mechanical equipment has been determined by the Engineer as meeting the requirements of the construction documents, and competent maintenance and repair service has been determined to be available in the locale of the project. The determination of availability of this equipment within the time required for contract performance is the responsibility of the Contractor.
- B. Substitutions, See the following:
 - 1. Section 20 01 00 - "GENERAL PROVISIONS", "Substitution of Equipment".

2.05 IN-LINE HOT AND/OR CHILLED WATER CIRCULATING PUMPS

- A. Furnish and install circulating pumps as scheduled on the drawings or approved equal. These requirements shall apply to separately-specified pumps and also to pumps specified and furnished as part of other equipment.
- B. Pumps shall be in-line, single-stage, capable of being serviced without disturbing piping connections, cast iron, and bronze fitted circulators.
- C. Cast bronze or brass impellers shall be of the enclosed type, dynamically balanced and firmly attached to the hardened alloy steel shaft.
- D. Pumps shall be rated for a minimum of 175 psi working pressure. Casings shall have gauge ports at nozzles, vent and drain ports at the top and bottom of the casing.
- E. Pumps shall have internally-flushed mechanical seals with a ceramic seal seat of at least 98% alumina oxide content and a carbon seal ring. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal.
- F. Pump bearing housing assembly shall have heavy-duty regreaseable ball bearings, replaceable without disturbing piping connections. A flexible coupling to dampen starting torque and torsional vibrations shall be employed.
- G. The pump motor shall meet NEMA specifications. The pump and motor shall be factory aligned, and shall be realigned by the contractor after installation.
- H. All pump motors for in-line pumps shall be sized to be non-overloading at fully open flow.
- I. Each pump shall be factory tested, thoroughly cleaned and painted with machinery enamel prior to shipment.
- J. Each pump shall be checked by the contractor and regulated for proper differential pressure, voltage, and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for the Owner's reference.

2.06 AIR SEPARATOR

- A. Furnish and install, as shown on plans, a centrifugal type air separator. The unit shall have flanged inlet and outlet connections tangential to the vessel shell. The unit shall have an internal stainless steel air collector tube with 5/32" (4mm) diameter perforations and 63% open area designated to direct accumulated air to the

compression tank on an air control system or an air vent on an air elimination system via an NPT vent connection at top of unit.

- B. A blowdown connection shall be provided to facilitate routine cleaning of the strainer and the separator. Manufacturer to furnish data sheet specifying air collection efficiency and pressure drop at rated flow.
- C. Vessel shell diameter is to be three times the nominal inlet/outlet pipe diameter, with a minimum vessel volume for sufficient velocity reduction. The air separator must be designed, constructed and stamped for 125 psig @ 350°F (862 kPa @ 177°C) in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors. The air separator(s) shall be painted with one shop coat of light gray air dry enamel.
- D. A manufacturer's Data Report for Pressure Vessels, Form U-1 as required by the provisions of the ASME Boiler and Pressure Vessel Code, shall be furnished for each air separator upon request.
- E. Each air separator shall be with system strainer.

2.07 EXPANSION TANK – BLADDER TYPE

- A. ASME rated pre-charged bladder-type pressure vessels are designed to absorb the expansion forces of heating/cooling system water while maintaining proper system pressurization under varying operating conditions. The heavy duty bladder shall contain system water to eliminate tank corrosion and waterlogging problems.
- B. Operating Data:
 - Maximum working pressure. 125 PSI
 - Maximum operating temperature. . . 240°F
- C. Materials of Construction:
 - System Connection: Forged Steel
 - Shell: Carbon Steel
 - Bladder: Heavy Duty Butyl Rubber
 - Designed and Constructed per ASME Section VIII, Division 1

2.08 TANK FITTINGS

- A. Furnish and install a compression tank fitting as shown on plans. It must contain an air separating trap and liquid control baffle to assure unrestricted air flow to the tank and air-free liquid flow from the tank. It must include a manual vent for adjustment of air volume in the tank. Cast iron.

2.09 SUCTION DIFFUSER

- A. Provide at each pump a Suction Diffuser for mechanical coupling systems of the size noted on drawings. Units shall consist of angle type body, grooved system connection, flanged pump connection, stainless steel inlet vanes and combination Diffuser-Strainer-Orifice Cylinder with 3/16 diameter openings for pump protection. The orifice cylinder shall be equipped with a disposable fine mesh strainer which shall be removed after system start-up. Orifice cylinder shall be designed to withstand pressure differential equal to pump shut-off head and shall have a free area equal to five times cross section area of pump suction opening. Vane length shall be no less than 2-1/2 times the pump connection diameter. Unit shall be provided with adjustable support foot to carry the weight of suction piping.

2.10 TRIPLE DUTY® VALVE – STRAIGHT PATTERN

- A. Furnish and install as shown on plans, a straight pattern valve designed to perform the functions of a nonslam check valve, throttling valve, shutoff valve and calibration balancing valve.
- B. The valve shall be a heavy-duty cast iron construction with standard 125 psig ANSI flanged connections, and rated for a maximum working pressure of 175 psig at 250°F. The valve shall be fitted with a bronze seat, replaceable brass disc with EPDM seat insert, stainless steel stem, and chatter-preventing spring and calibrated nameplate. The valve design shall permit repacking under full system pressure.
- C. The valve shall be equipped with brass readout valve (with integral check valve) for taking differential pressure readings across the orifice for accurate system balance.

2.11 PUMPS - BASE MOUNTED

- A. Base-mounted pumps shall be designed with back pull-out construction to allow servicing the pump without removing the piping connections. Seals shall be mechanical. Shaft couplings shall be spacer-type, with cylindrical rubber element. Pumps shall be bronze fitted.
- B. For base-mounted pumps, provide drip pans under pump body. Pour concrete base as shown.
- C. All pump motors for base-mounted pumps shall be non-overloading at fully open flow. Motors for base-mounted pumps shall be open drip-proof type, high efficiency, with minimum of 1.15 service factor.

PART 3 - EXECUTION

3.01 INSTALLATION AND CONNECTION

- A. Installation and connection of pumps and associated systems shall be in accordance with applicable local codes and regulations, and manufacturer's published installation instructions.
- B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level.
- C. Controls: Conform to Section 25 50 00 - "CONTROLS AND INSTRUMENTATION."
- D. Connect piping in accordance with Section 23 21 13 - "HYDRONIC PIPING."

3.02 EQUIPMENT INSTALLATION

- A. Set or hang all mechanical equipment square with building lines, level and at elevations required to clear other work. Secure properly, in accordance with the equipment manufacturer's instructions. Set units so as to allow sufficient clearance for proper installation of all piping, power and control wiring and work of any other contractor.
- B. Provide a 4" concrete housekeeping pad under all boilers and base-mounted pumps. Coordinate size and location as required to match equipment layout.
- C. Install pumps in accordance with details on drawings, including all valves, gauges, vibration isolation couplings, etc. as shown. Lay out piping in advance of pump placement to assure adequate space for all fittings, valves, and trim. Recheck motor alignment after installation.

3.03 COMMISSIONING

- A. Test functions, operations, and control sequences and protective features. Adjust to assure operation is in accordance with specification.
- B. Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.04 CLEANING AND ADJUSTING

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".

END OF SECTION 23 21 23

SECTION 23 23 00 - REFRIGERANT PIPING**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- | | |
|---|-------------------------|
| A. Refrigerant piping used for air conditioning applications. | B. Special duty valves. |
| C. Pipes, tubing, fittings, and specialties. | D. Refrigerants. |

1.03 RELATED WORK

- A. Architectural Division Sections "FIRESTOPS" and "JOINT SEALERS" for materials and methods for sealing pipe penetrations through basement walls and fire/smoke barriers.
- B. Section 20 03 00 - "MATERIALS AND METHODS".
- C. Section 20 06 00 - "MECHANICAL IDENTIFICATION".
- D. Products installed but not furnished under this Section include pre-charged tubing, refrigerant specialties, and refrigerant accessories furnished as an integral part of or separately with packaged air conditioning equipment.

1.04 SUBMITTALS

- A. Product data for the following products:
- | | |
|-------------------------------|--|
| 1. Each type valve specified. | 2. Each type refrigerant piping specialty specified. |
|-------------------------------|--|
- B. Shop Drawings showing layout of refrigerant piping, specialties, and fittings including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximate to equipment.
- C. Maintenance data for refrigerant valves and piping specialties, for inclusion in Operating and Maintenance Manual specified in Section 20 01 00 - "GENERAL PROVISIONS."

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the following codes:
- | |
|---|
| 1. ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping. |
| 2. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration. |

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Refrigerant Valves and Specialties
- | | |
|---|--|
| 1. Alco Controls Div, Emerson Electric. | 2. Henry Valve Company. |
| 3. Danfoss Electronics, Inc. | 4. Parker-Hannifin Corp., Refrig. and A/C Div. |
| 5. EATON Corporation, Control Div. | 6. Sporlan Valve Company. |
- B. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 PIPE AND TUBING MATERIALS

- A. Refer to Part 3, Article "Pipe Application" for identification of systems where the below specified pipe and fitting materials are used.
- B. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

2.03 FITTINGS

- A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

2.04 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

2.05 VALVES

- A. All valves shall be incorporated in the mechanical equipment.

2.06 REFRIGERANT PIPING SPECIALTIES

- A. Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.
- B. Strainers: 500 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.
- C. Moisture/liquid Indicators: 500 psig maximum operation pressure, 200 deg. F. maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.
- D. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:
 - 1. High capacity desiccant sieves to provide micronic filtration and extra drying capacity.
- E. Suction Line Filter-Drier: 350 psig maximum operation pressure, 225 deg. F. maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant for removal of acids and moisture for refrigerant vapor.
- F. Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.
- G. Refrigerant Accumulator: 350 psig maximum operation pressure; provide refrigerant accumulators whenever refrigerant piping is routed below grade.

2.07 REFRIGERANT

- A. Refrigerant No. 410a.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.

3.02 PIPE APPLICATIONS

- A. Use Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Mechanical fittings (crimp or flare) are not permitted.

- B. If other than Type ACR tubing is used, clean and protect inside of tubing as specified in Article "Cleaning" below.

3.03 PIPING INSTALLATIONS

- A. Install refrigerant piping in accordance with ASHRAE Standard 15 - "The Safety Code for Mechanical Refrigeration."
- B. Install piping in as short and direct arrangement as possible to minimize pressure drop.
- C. Install piping for minimum number of joints using as few elbows and other fitting as possible.
- D. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.
- E. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.
- F. Insulate suction lines with ¾" "Armaflex" or equal. Liquid line is not required to be insulated, except where installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.
1. Do not install insulation until system testing has been completed and all leaks have been eliminated.
- G. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.
- H. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- I. Slope refrigerant piping as follows:
1. Install horizontal suction lines with ½ inch per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
2. Install traps and double risers where indicated, and where required to entrain oil in vertical runs.
3. Liquid lines may be installed level.
- J. Use fittings for all changes in direction and all branch connections.
- K. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- L. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- M. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- N. Locate groups of pipe parallel to each other, spaced to permit applying insulation and servicing of valves.
- O. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.
- P. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials.
- Q. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
- R. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.
- S. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.
- T. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.
- U. Install flexible connectors at the inlet and discharge connection of compressors.

3.04 HANGERS AND SUPPORTS

- A. General: Hanger, supports, and anchors are specified in 20 03 00 - "MATERIALS AND METHODS."
- B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
- C. Install hangers with a maximum spacing of 8 feet on centers.

3.05 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
 - 1. **WARNING:** Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
 - 2. **CAUTION:** When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.
- B. Fill the pipe and fittings during brazing, with an inert gas (i.e., nitrogen or carbon dioxide) to prevent formation of scale.
- C. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

3.06 EQUIPMENT CONNECTIONS

- A. The Drawings indicate the general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow servicing and maintenance.

3.07 FIELD QUALITY CONTROL

- A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.
- B. Repair leaking joints using new materials, and retest for leaks.

3.08 ADJUSTING AND CLEANING

- A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.
- B. Clean and inspect refrigerant piping systems in accordance with requirements of Section 20 03 00 - "MATERIALS AND METHODS" Article "Pipes and Pipe Fittings".
- C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.09 COMMISSIONING

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".

END OF SECTION 23 23 00

SECTION 23 30 00 - AIR DISTRIBUTION**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 4. General Conditions. |
| 2. General Provisions of the Contract. | 5. Supplementary Conditions. |
| 3. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. Provide all ductwork with extractors, dampers, turning vanes, hangers, etc., as indicated on the drawings, as specified and as required to complete this portion of the work in conjunction with the air distribution system.
- B. Provide factory fabricated units, exhaust fans, wall louvers, access doors, fire dampers, security grilles, grilles, registers, diffusers, etc., as specified and as shown on the drawings.
- C. Provide control dampers, fire dampers, and balancing dampers as shown on drawings or as required for proper duct system operation.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 20 01 00 - "GENERAL PROVISIONS" for the following equipment:
- | | |
|--------------------------------------|-----------------------------|
| 1. Registers, grilles and diffusers. | 2. Duct liner. |
| 3. Fire dampers. | 4. Sealing materials |
| 5. Exhaust fans. | 6. Fire stopping materials. |
- B. NFPA Compliance: Comply with the following:
- NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Duct lining materials, separately and in combination shall be UL listed and shall have maximum fire hazard classifications of flame spread 25 and smoke development 50.
- B. Units shall be factory assembled and tested. Fan ratings to be based on current AMCA Standards.
- C. Roof exhaust fans shall bear AMCA seal.
- D. Fire dampers shall conform to requirements of National Fire Protection Association and the state and local fire marshal.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Grilles and Registers
- | | |
|---------------|-----------------------|
| 1. Anemostat. | 2. Titus. |
| 3. Carnes. | 4. Tuttle and Bailey. |
| 5. Price. | 6. Nailor |
| 7. Krueger | |
- B. Louvers and Dampers
- | | |
|------------------------|--------------------------|
| 1. Airline. | 2. Louvers & Dampers Co. |
| 3. Carnes. | 4. Nailor. |
| 5. Greenheck. | 6. Cesco. |
| 7. Industrial Louvers. | 8. Ruskin. |
| 9. Vent Products. | 10. NCA |

- 11. Pottorff.
- C. Flexible Ducts
 - 1. Atco.
 - 2. Hart & Cooley.
 - 3. JPL.
- D. Fabric Duct
 - 1. Ductsox Fabric Air Dispersion System
 - A. From Melt Safety Products Dubuque, IA (800) 553-5560.
- E. Acoustical Duct Lining
 - 1. Certain-Teed "Ultralite Duct Liner".
 - 2. Owens-Corning "Aeroflex Type 200".
 - 3. Johns-Manville "Linacoustic RC".
- F. Duct Wrap Insulation
 - 1. Certain-Teed Standard Duct Wrap.
 - 2. Owens-Corning All-Service/100
- G. Bellmouth Fittings
 - 1. Buckley #BMD.
- H. Fire Dampers
 - 1. Air Balance.
 - 2. Ruskin.
 - 3. Cesco.
 - 4. Vent Products.
 - 5. United Air
 - 6. Greenheck
 - 7. Nailor
 - 8. Carnes
 - 9. NCA
 - 10. Pottorff.
- I. Air Filters
 - 1. Airguard Industries - DP-40-2.
 - 2. Continental Filters Company - Areopleat.
 - 3. American Air Filter - AM AIR 300X.
 - 4. Farr - 30/30.
- J. Fans
 - 1. Cook
 - 3. Carnes
 - 2. Greenheck
 - 4. Acme
- K. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 DUCTS - GENERAL

- A. Ductwork, unless otherwise shown, shall be galvanized steel sheets or aluminum alloy 3003.
- B. Where ducts will be exposed and painted, use "Paint-Grip" galvanized steel (this includes spiral duct).
- C. Ducts, unless otherwise approved by the Engineer, shall conform accurately to the sizes indicated on the drawings and shall be straight and smooth on the inside, with joints neatly finished.
- D. Ducts shall be securely anchored to the building in an approved manner and shall be installed so as to be completely free from vibration under all conditions of operation.
- E. Turning vanes shall be installed in all elbows, in both supply and return ducts.
- F. Do not install any radiused elbows (applies to fabricated rectangular duct only).
- G. Sheet metal ducts shall be properly braced and reinforced.
- H. Specific ducts require sealing of joints. See paragraph "Duct Sealing"

2.03 LOW PRESSURE - DUCTS - RECTANGULAR

- A. Ducts (unless noted otherwise on drawings) shall be constructed in accordance with SMANCA low pressure duct construction standards for 1" w.c. pressure. For convenience, they may be constructed per the following table:

<u>DIMENSION</u>	<u>GAUGE</u>	<u>REINFORCING</u>	<u>MAX SPACING</u>
0" - 12"	26	None	
13" - 26"	26	1" standing "S"	5'0"
27" - 42"	24	1" standing "S"	4'0"
43" - 60"	22	1" x 1" x 1/8" angle	2'6"

Install reinforcing on four sides of duct where depth exceeds 16"; install on two sides only where duct depth is

16" or less.

- B. All rectangular duct with dimensions over 12" shall be cross-broken to prevent "oil-canning."
- C. At the Contractor's option, the rectangular ducts may be assembled with transverse joints made with the "Ductmate" system or an approved equal. If used, the Ductmate joints shall be assembled with corners, cleats and gasket tape per the manufacturer's instructions. Additional duct sealant is not required with the "Duct Mate" system. Duct metal gauges may be reduced per the ductmate recommendations.

2.04 EXTERIOR DUCT

- A. Exterior duct shall be:
 - 1. Prefabricated, pre-insulated thermaduct, or an approved equal.
 - 2. Duct shall be 1 3/16" thick, R = 14.1

2.05 LOW PRESSURE – DUCTS - ROUND

- A. Definition of low pressure: Maximum of 1" w.g. static negative to a maximum of 2" w.g. static positive.
- B. Round low-pressure ductwork in concealed locations shall be galvanized steel "Snaplock" pipe, insulated as per "DUCT WRAP INSTALLATION" in Part 3. See also "DUCT SEALING" in Parts 2 and 3, for information on duct joints that require sealing.
- C. Round ducts:
 - 1. This section supersedes the latest SMACNA standards.
 - 2. Construct round ducts from steel sheets of the U.S. gauge thickness shown in "Round Duct Gauge Selection" chart below:
- D. SPIRAL DUCT (single wall): Where indicated on drawings, round ductwork shall be spiral galvanized round ducts. Unless noted otherwise, all spiral duct shall be single-wall. Spiral duct shall conform to SMACNA duct construction standards Section III. Spiral seams shall be lockformed or continuous-welded. Elbows referred to as "radiused" may be gored elbows, 5 sections minimum. Duct sizes may be increased 1" as required to allow "nesting" for economical shipment. See also "DUCT SEALING" in Parts 2 and 3. See "Round Duct Gauge Selection" chart below for required gauge thickness:

**ROUND DUCT GAUGE SELECTION
GALVANIZED STEEL**

Duct Diameter in Inches	Maximum 2" w.g. Static Positive	
	Spiral Seam Gauge	Longitudinal Seam Gauge
3 thru 8	28	28
9 thru 14	28	26
15 thru 26	26	24
27 thru 36	24	22
37 thru 50	22	20
51 thru 60	20	18
61 thru 84	18	16

- E. SPIRAL DUCT (double wall): Where indicated on drawings, double wall round ducts shall be spiral galvanized round ducts "United" "ACOUSTI-k27" or approved equal.
 - 1. All double-wall spiral duct shall be constructed of a perforated metal inner liner, 1" thick layer of fiberglass insulation, and an outer pressure metal shell.
 - 2. The perforated metal inner liner shall have 3/32" perforations with an overall open area of 23%.
 - 3. The 1" thick fiberglass shall have a maximum thermal conductivity (k) factor of 0.27 BTUH per square foot per dgF per inch thickness at 75dgF mean ambient temperature.
 - 4. Spiral duct shall conform to SMACNA duct construction standards Section III. Spiral seams shall be lockformed or continuous-welded.

5. Double-wall spiral duct shall be constructed in accordance with SMACNA duct construction standards or for convenience per the following table:

<u>INNER LINER DIMENSION</u>	<u>OUTER SHELL GAUGE</u>	<u>INNER LINER GAUGE</u>	<u>INNER LINER CONSTRUCTION</u>
3" - 8"	26	28	Standard Spiral
9" - 12"	26	28	Ribbed Spiral
13" - 24"	24	28	"
25" - 34"	22	28	"
35" - 42"	20	28	"
44" - 48"	20	26	"
50" - 60"	18	26	"
62" - 82"	18	22	Standard Spiral

2.06 LOW PRESSURE - FLEX DUCT

- A. Provide preinsulated R4.2 (or better), flexible duct listed as UL-181 Class 1 air duct and constructed in compliance with NFPA 90 A, subject to approval of submittals. It shall be used only for runouts to supply or return diffusers (not for exhaust) and only in lengths of 8' or less. Provide nylon, self-extinguishing, locking clamps to secure flexible duct.

2.07 MEDIUM PRESSURE SHEET METAL DUCT SYSTEMS

- A. Definition of medium pressure duct: duct systems where duct pressures range from 3" W.G. negative static to a maximum of the (10) inches W.G. static positive pressure and/or duct velocities exceed 2000 FPM.
- B. Duct Construction:
1. Construct duct from fan discharge to terminal units using round or oval ducts fabricated from galvanized steel sheet in accordance with SMACNA High Pressure Duct Construction Standards, latest edition.
 2. Construct plenums to withstand 10" W.G. positive static pressure and 3" W.G. negative static pressure including all plenum devices such as access doors, dampers and damper banks.
- C. Seams and Joints:
1. Longitudinal Seams: Butt welded or lock-type joint.
 2. Spiral Seams: Lock type joint.
- D. Transverse Joints
1. 36" Diameter and Smaller: Four inch long slip joint.
 2. Larger than 36" Diameter: Vanstone joint.
- E. Rectangular Double-Wall Duct and Fittings
1. Construct using United McGill's rectangular-k27® duct and fittings.
 2. Double-wall, insulated ductwork shall be constructed of a solid metal outer pressure shell and a metal inner liner with a layer of insulation sandwiched between.
 3. Standard construction shall be galvanized steel with a perforated liner and 2 inch-thick fiberglass insulation.
 4. Rectangular-k27® duct and fittings shall be fully assembled with TDC™ transverse duct connector flanged ends.
 5. Double-wall duct and silencers shall be rated for airflow velocities up to 4,000 feet per minute and shall have been tested according to UL 181 standards at airflow velocities of 10,000 feet per minute with no evidence of insulation erosion.
- F. Medium Pressure Round Ducts:
1. This section supersedes the latest SMACNA standards.

2. Construct medium pressure round ducts from steel sheets of the following U.S. gauge thickness, using the seam method shown in the following chart:

**MEDIUM PRESSURE
ROUND DUCT GAUGE SELECTION
GALVANIZED STEEL**

Duct Diameter in Inches	Maximum 10" w.g. Static Positive*	
	Spiral Seam Gauge	Longitudinal Seam Gauge
3 thru 8	26	24
9 thru 14	26	24
15 thru 26	24	22
27 thru 36	22	20
37 thru 50	20	20
51 thru 60	18	18
61 thru 84	18	16

G. Fittings, Couplings, and Other Joints:

1. Construct using 22 gauge minimum sheets. Spot weld along seams according to accepted trade practices.
2. Provide runout fittings such as Y's, 45dg., 90dg., conical 90dg. With baffle as detailed on the runout fitting schedule. Design "tap-on" installation. Provide runout fittings requiring an orifice with orifice "built-in."
3. Make connections using sheet metal screws. Apply United Sheet Metal United Duct Sealer or Hardcast Iron Grip Water Duct Sealant 601 to all joints to eliminate leakage.

2.08 MEDIUM PRESSURE FLEXIBLE DUCT SYSTEMS

- A. Definition: Duct systems where duct pressures exceed two inches W.G. static pressure and/or duct velocities exceed 2000 FPM.
- B. Do not use flexible duct unless specifically called for on the plans.
- C. Connection between the main duct and the terminal box:
 1. Provide insulated flexible duct listed as UL-181 Class I air duct and constructed in compliance with NFPA 90A. Insulated flexible duct equal to "Thermoflexs" type #MK-E or approved equal. Fasten with 1/2" wide positive linking metal bands.
- D. All ducts 4" through 8" diameter rated 6" W.G. minimum static pressure, ducts 9" through 16" diameter rated 4" W.G. minimum static pressure.

2.09 EXHAUST DUCTS

- A. Exhaust ducts shall be round or rectangular galvanized steel as shown on the plans. Flexible duct is not permitted. Do not line or insulate exhaust ducts, except as called for on the drawings and as specified below.

2.10 DUCT SEALING

- A. All transverse duct joints shall be sealed during or after assembly with "United" "Uni-Seal" (synthetic elastomeric duct sealer or equal. No leakage shall be detectable when the duct is pressurized to 1" water column above the maximum working pressure to be experienced by the system. Un-Sealed duct joints are not acceptable.
- B. Duct tape, if used, shall be equal to "Venture Tape" #1502, silver. Metalized, polyethylene cloth tape with pressure sensitive adhesive. Minimum 10 mil. Thickness.
- C. See PART 3 -EXECUTION, "DUCT SEALING", for application.

2.11 ACOUSTICAL DUCT LINING

- A. Unless noted otherwise, acoustical duct lining shall be 1" thick 1-1/2 lb./cu. ft. density. The lining shall have a minimum R-value of 3.6 @ 75°F mean temperature.
- B. Where 2" liner is called for, acoustical liner shall be 2" thick, 3 lb./cu. ft. density. The lining shall have an R-value of 8.3 @ 75°F mean temperature. Do not substitute 2 layers of 1" thick liner.

2.12 DUCT WRAP INSULATION

- A. Duct wrap insulation shall be 1-½" thick, 1 lb./cu. ft. density, fiber glass type, with foil scrim kraft facing. The insulation shall have an R-value of 5.7 @ 75°F. mean temperature.

2.13 FLEXIBLE CONNECTIONS

- A. Where sheet metal connections are made to fan or where ducts of dissimilar metal are connected, a noncombustible flexible connection of approved noncombustible material approximately 6 inches in width, conforming to ASTM Specification D1571-67, shall be installed.

2.14 INSPECTION AND ACCESS DOORS

- A. Doors shall be 15" x 15" unless otherwise indicated. Where size of duct will not accommodate this size, the doors shall be made as large as possible without weakening duct. Man-size access doors shall be rigid, and shall be provided with airtight neoprene gaskets. Doors shall be provided with galvanized piano hinges and two Camlock brass fasteners. Man-size access doors shall be provided with door handles operable from both sides. Doors in insulated ducts shall be of the insulated type.

2.15 HANGERS AND SUPPORTS FOR DUCTS

- A. Install rigid round, rectangular, and flat oval 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 within 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 ¼ of the failure (proof test) load but are not limited to the specific methods indicated.

2.16 REGISTERS AND GRILLES

- A. Registers and grilles shall be of the size indicated on the drawings. Registers and grilles shall have vanes slanted to prevent direct sight into grille.
- B. Anything visible through grille in customer contact and office areas shall be painted flat black.
- C. Provide anti-smudge rings on all ceiling diffuser located in gypsum board and lay-in ceilings. Where ceiling height permits.
- D. Provide opposed-blade dampers in all exhaust registers.

2.17 BELLMOUTH FITTINGS

- A. Supply air branch duct bellmouth fittings shall be equipped with dampers having an operating handle and a locking device. Bellmouth fittings of 16" size and larger shall have dampers with locking quadrant type operating handle, and shall clearly indicate damper position. Extension rods shall be installed where necessary. Each branch duct takeoff shall be provided with a bellmouth fitting with damper. Bellmouths shall be heavy-duty galvanized steel with neoprene gasket and 26 gauge galvanized damper.
- B. "Spin-in" fittings, "high-efficiency takeoffs" or job-fabricated tap units are not acceptable for supply air ducts.

2.18 FIRE DAMPERS

- A. Fire dampers shall have the following features:
 1. UL #555 listed and labeled to close, if activated, even if air distribution system is in operation.
 2. One piece steel frame.
 3. Steel blades with interlocking joints. Blades in airstream.
 4. Stainless steel negator closure spring if required for horizontal mounting.
 5. 160 degree F. U.L. listed fusible links and blade locks.

2.19 FANS

A. Power Roof Exhaust:

1. Fans: Aluminum construction including rectangular housing, base, wheel and venturi, furnished with aluminum bird screen, built-in disconnect switch, automatic or motorized as indicated, (felt edge) back draft damper and pre-fabricated insulated aluminum roof curb. Fan base shall overlap and protect the curb. Fan bases shall be hinged as indicated in schedule.
2. Provide each fan with wheel, size, RPM, horsepower and CFM as shown on the schedule.
3. Fan motors shall have built-in overload protection with a disconnect switch mounted inside the fan housing. Permanently lubricated fan bearing and motor shall be located in a separate compartment out of the air stream. Belt drives shall be adjustable.
4. Fan wheels: Direct or belt driven, as scheduled, of the centrifugal type, backwardly inclined, aluminum, statically and dynamically balanced and quiet operating.
5. Support curbs for roof mounted fans: 8" minimum high with ¼ " sponge rubber pad on top and 2" of thermal and acoustical insulation on the inside, constructed of galvanized steel or aluminum. Curbs shall be of welded construction, made to match the roof system being used on the project.

B. Inline Exhaust:

1. Ceiling ventilator shall be direct drive, forward curved, centrifugal blower type. Fan wheel shall be constructed of galvanized steel and shall be dynamically balanced. The housing shall be constructed of galvanized steel and acoustically insulated for quiet operation. An integral aluminum backdraft damper shall be standard. Blower and motor assembly shall be easily removable from the housing without disturbing the ductwork. The motor shall be permanently lubricated with built-in thermal overload protection and shall be factory tested prior to shipment. The unit shall be supplied with an internal wiring box and receptacle. The discharge position shall be adjustable by moving interchangeable panels supplied with removable fasteners.
2. Ceiling ventilators shall be certified and licensed to bear the AMCA Seal for Air and Sound Performance. Ceiling ventilator performance shall be based on tests and procedures performed in accordance with AMCA publication 211 and comply with the requirements of the AMCA Certified Ratings Program. Fan sound power level ratings shall be based on tests and procedures performed in accordance with AMCA publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Ceiling ventilators shall be UL Listed.

2.20 AIR FILTERS

- A. Air filters shall be 2" thick medium efficiency, pleated disposable type. Each filter shall consist of cotton media wire bonded to a heavy duty paperboard frame. Filters shall have not less than 4.25 sq. feet of gross media area per sq. ft. filter area.
- B. Filters shall have an average efficiency of 25-35% when tested in accordance with ASHRAE 52-76 standard.
- C. Initial clean resistance shall be no more than 0.14 inches W.G. when passing air at the rate of 300 feet per minute.
- D. The air filters shall be listed by Underwriters Laboratories as UL Class 2.
- E. Provide clean set of air filters prior to final acceptance and complete extra set left on site.
- F. Install filters in filter grilles and remove filters from units so equipped, but only at completion of construction.

PART 3 - EXECUTION

3.01 DUCT INSTALLATIONS

- A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.
- B. Ducts shall be of the internal dimensions shown on the Drawings. In no case shall the Contractor change the indicated size of the ductwork without approval of the Engineer. Wherever necessary to change the shape of the duct, it shall be done gradually and the full area retained.
- C. Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable

noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. All joints shall be sealed with duct sealant. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. 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.

- D. Ducts 24 inch or greater in width or height shall be stiffened with galvanized structural angle reinforcing, not to exceed 4 ft. on centers and on all four surfaces, to prevent sagging or buckling and to provide a rigid installation and freedom from vibration and noise. Where angle cleats are made of same gauge metal as ducts (or heavier) the angle cleats will serve as reinforcing members on two surfaces of the ducts at joints in the ducts. Additional reinforcing angles shall be provided adjacent to branch duct connections which are of less width or depth than the surface of the main duct at point of connection, and at all other locations as necessary to make the duct work free from noise and vibration when fans are operating.
- E. This Contractor shall carefully check the arrangement of ducts and dimensions for all working spaces at the building so that there will not be interference with the running of ducts.
- F. Where ducts pass through walls and ceilings (exposed and concealed), this Contractor shall provide bent angle collar (as required to cover annular space) having flanges at corners lapped and riveted and the other leg of angle cut short and bent around corner of duct. Collars shall serve to confine sound barrier packing and shall fit tight around ducts. Where more than one duct passes through the same opening the collars shall form a complete seal of the spaces between and around all such ducts. This shall apply to concealed ductwork as well as exposed ductwork. The space between the duct and wall shall be packed with fiberglass duct-seal to provide an effective sound and dust barrier. Where the bent angle collar in any wall opening must support masonry in the wall above the opening, the top member of the bent angle collar shall be reinforced with rolled section steel angles suitable for the weight to be carried as approved by the Engineer and placed so as to be concealed in the wall in all locations where exposed in finished rooms.

3.02 FLEXIBLE CONNECTIONS

- A. Flexible connections shall be securely fastened by zinc-coated iron clinch-type draw bands, for round ducts. For rectangular ducts, flexible connections locked to metal collars shall be installed using normal duct construction methods.

3.03 ACCESS DOORS

- A. Access doors in ducts shall be provided at all fire dampers, motorized dampers, and where indicated on the drawings. On low-pressure rectangular ductwork, all access doors shall swing to the outside of the duct. On all other rectangular ducts, doors shall swing so that fan pressure or suction holds the door closed, unless otherwise indicated. Access doors in ductwork with duct liner or insulation shall be insulated. Access doors in round duct can be sandwich or saddle type.

3.04 HANGING OF DUCTS

- A. Horizontal ducts shall be supported with angle and rod trapeze or strap hangers per SMACNA standards. Strap hangers shall be placed around sides and bottom of ducts with sheet metal screws in sides and bottom. Trapeze hangers shall be securely fastened to ducts and to the construction above. Horizontal duct supports shall be spaced not to exceed 8 ft. apart and not less than one trapeze support per section of duct. Seal hanger penetrations in ductwrap insulation with aluminized vapor barrier tape.
- B. Ducts constructed with "Ductmate" or similar joints shall be hung by attachments to the duct's flanges.
- C. Special hanging systems, where indicated, will be installed in lieu of duct supports specified above.
- D. No equipment or ductwork shall be hung from roof deck.

3.05 BELLMOUTH FITTINGS

- A. Install bellmouth fitting with damper in each supply air branch takeoff. Mark damper open and closed positions on side of duct with black paint.
- B. Fittings shall be secured in duct with screws. Operators shall be outside the duct system. All holes shall be carefully covered and sealed.

- C. Large round duct take-offs from rectangular ducts or plenums shall be equipped with bellmouth fittings. Dampers are not required in these fittings unless shown on drawings.

3.06 FIRE DAMPERS

- A. Fire dampers shall be installed as required by NFPA 90A, and as indicated on the drawings. Fire dampers must be installed in a sleeve installed in the wall prior to installing the duct and damper. Gauge of the damper shall be at least as heavy as the duct. Sleeve gauge shall be heavier where required to comply with fire rating requirements or structural requirements of the wall. Steel retaining angles shall be screwed, bolted, or welded to sleeve on both sides of wall, with duct connected to sleeve on both sides with slip connector held with not less than one No. 8 sheet metal screw on each vertical side of duct.

3.07 INSTALLATION OF EQUIPMENT

- A. Install all fans, fire dampers, registers, grilles, etc., per manufacturer's recommendation and instructions.
- B. Care shall be taken with installation of roof exhaust fans and roof vents to prevent damage. Any fan or vent dented or damaged in any other way during construction shall be repaired or replaced.

3.08 DUCT SEALING

- A. Duct Tape shall be installed at the following locations:
 - 1. All transverse joints of low pressure round "snaplock" pipe.
- B. Duct Sealant shall be installed on all transverse joints at the following locations:
 - 1. All sheet metal rectangular ducts.
 - 2. All medium and high pressure round metal ducts.
 - 3. Do not seal joints of exposed low pressure ducts in finished areas.

3.09 ACOUSTICAL DUCT LINING - INSTALLATION

- A. Acoustically line ducts as called for with duct liner and install as called for in latest edition of manufacturer's installation manual and/or as called for or shown on pages 2-24 to 2-27 of the SMACNA HVAC Duct Construction Manual - 1995.
- B. Adhere liner with coated side toward air stream to all interior sides of duct with 100% coverage of fire-resistant insulation bonding adhesive. Adhesive shall completely cover sheet metal at each end of each section of ductwork. Provide Z bar liner retainer on leading edge of liner in the first fitting downstream of any fan.
- C. When duct width or height exceeds 12" further secure the liner to these surfaces with mechanical fasteners at 16" o.c.
- D. Velocities - 1500 to 4000 FPM: Install as above but additionally paint all joints of liner and butter the edges of liner where sections of ductwork will be joined with fire-resistant mastic.
- E. Note: All duct sizes shown are inside of linings. Increase sheet metal sizes as required to provide the finished inside dimensions shown on the drawings.
- F. Acoustical duct lining shall be installed at the following locations:
 - 1. All sheet metal rectangular supply air, outside air, and return air duct work, as well as all fabricated plenums associated with the above ductwork. Omit lining where so specified on the drawings.

3.10 DUCT WRAP - INSTALLATION

- A. Wrap all ducts (as called for below) with duct wrap and install as called for in latest edition of manufacturer's installation manual.
- B. Install duct wrap with vapor barrier outward to all sides of duct.
- C. When duct width or height exceeds 24" further secure the duct wrap to these surfaces with mechanical fasteners at 16" o.c.
- D. Duct wrap shall be installed at the following locations:
 - 1. All concealed round return, supply, and outside air ducts.
 - 2. All supply and return air ducts within roof-ceiling assemblies (attics) that are vented to the outside and

where otherwise exposed to outside ambient temperatures.

3. All ducts where wrapping is called for on the drawings.
 4. All medium-pressure round and rectangular ducts.
- E. Seal all seams and penetrations with aluminized vapor barrier tape.

3.11 EXTERIOR DUCT INSTALLATION

- A. Support exterior ducts with heavy-duty supports as detailed on drawings or as required for a permanent installation. Secure all supports as required. Use no light-gauge components.
- B. Seal all duct joints as specified or as recommended by the duct manufacturer.

3.12 EXHAUST DUCTS - UNINSULATED

- A. Except as noted on the drawings, exhaust ducts shall not be insulated or lined. Existing insulated exhaust ducts shall remain as-is.

3.13 ADJUSTING AND CLEANING

- A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Section 23 05 93 - "TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS" for requirements and procedures for adjusting and balancing air systems.

END OF SECTION 23 30 00

SECTION 23 52 33 - HEATING BOILERS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Provisions of the Contract.
 3. Solicitation Documents.
 4. General Conditions.
 5. Supplementary Conditions.
 6. Architectural Division.

1.02 WORK INCLUDES

- A. This Section includes units and accessories listed below, complete with controls.
1. Boilers.

1.03 RELATED WORK

- A. Section 23 30 00 - "AIR DISTRIBUTION".

1.04 SUBMITTALS

- A. Submit the following in accordance with Conditions of Contract and Architectural Division Specification Sections:
1. Product data including weights and dimensions and data on features and components. Include plan and elevation views of units, minimum clearances, and data on ratings and capacities.
 2. Maintenance data for products for inclusion in "Operating and Maintenance Manual" specified in Architectural Division.
 3. Wiring diagrams from manufacturers detailing electrical requirements for power and control wiring for furnaces. Include ladder-type wiring diagrams for interlock and control wiring required for field installation. Differentiate between portions of wiring that are factory installed and portions that are to be field installed.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70, "National Electrical Code."
- B. NRTL Listing: Provide electrical components specified in this Section that are listed and labeled.
1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.06 DEFINITIONS

- A. Control Wiring: Wire, conduit, and miscellaneous materials for mounting and connecting electric control devices.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Boilers
1. Raypak.
- B. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 CONTROLS

- A. Include control components required for satisfactory operation of units and auxiliary equipment in all seasons, including:
 - 1. Control Transformer: 24V a.c. output, factory-installed and wired.
 - 2. Relays: As required to achieve specified operation.

2.03 SUMMARY

- A. Section includes condensing gas-fired, copper finned-tube hydronic heating boilers.
- B. Related Sections
 - 1. Hydronic Piping – Division 23 21 13.
 - 2. (Venting) – Division 20 03 00.
 - 3. HVAC Instrumentation and Controls – Division 23 09 00.
 - 4. Electrical – Division 23 09 23.

2.04 REFERENCES

- A. ASME, Sections IV and VIII.
- B. ANSI/ASHRAE 15-1994, Section 8.13.6
- C. National Fuel Gas Code, ANSI Z223.1/NFPA 54.
- D. National Electric Code, ANSI/NFPA 70.
- E. ASME CSD-1, 2009 (when required).

2.05 SUBMITTALS

- A. Product data sheet (including dimensions, rated capacities, shipping weights, accessories).
- B. Wiring diagram.
- C. Warranty information.
- D. Installation and operating instructions.

2.06 QUALITY ASSURANCE

- A. Certifications
 - 1. ASME H Stamp and National Board Listed – Primary Heat Exchanger.
 - 2. ASME U Stamp and National “Board listed – Secondary Heat Exchanger.
 - 3. ISO 9001.

2.07 HEAT EXCHANGER WARRANTY

- A. Limited five-year warranty (copper) from date of installation.
- B. Limited twenty-five-year thermal shock warranty.
- C. Limited ten-year closed-system heat exchanger warranty.
- D. Limited ten-year secondary heat exchanger warranty.

2.08 MANUFACTURER

- A. Raypak, Inc.
 - 1. Product: XTherm™ condensing water-tube hydronic boiler(s).

2.09 BOILERS

- A. General
 - 1. The boiler(s) shall be fired with Natural gas.
 - 2. The boiler(s) shall be ASME inspected and stamped and National Board registered for 160 PSIG maximum

allowable working pressure and 250° maximum allowable temperature, complete with a Manufacturer's Data Report.

B. Primary Heat Exchanger

1. The primary heat exchanger shall be of a single-bank, vertical multi-pass design and shall completely enclose the combustion chamber for maximum efficiency. The tubes shall be set vertically and shall be rolled into a powder-coated, ASME boiler quality, carbon steel tube sheet.
2. The primary heat exchanger shall be sealed to 160 PSIG rated cast iron headers with silicone "O" rings, having a temperature rating over 500°F (bronze headers optional).
3. The low water volume primary heat exchanger shall be explosion-proof on the water side and shall carry a twenty-five-year warranty against thermal shock.
4. The headers shall be secured to the tube sheet by stud bolts with flange nuts to permit inspection and maintenance without removal of external piping connections. A heavy gauge stainless steel slotted wrap shall ensure proper combustion gas flow across the copper-finned tubes.
5. The flue connection, combustion air opening, gas connection, water connections, electrical connections and condensate drain shall be located on the rear.
6. The primary heat exchanger shall have accessible boiler drain valves with hose bibs to drain the water section of the primary heat exchanger.

C. Secondary Heat Exchanger

1. The secondary heat exchanger shall be a single-bank, multi-pass design constructed of stainless steel and bears the ASME U stamp.
2. The boiler(s) shall be capable of operating at inlet water temperatures as low as 50°F.

D. Condensate Drain

1. The boiler(s) will feature a condensate drain switch which will shut down the boiler(s) if the condensate drain is blocked.

E. Burners

1. The combustion chamber shall be of the sealed combustion type employing the Raypak high temperature FeCrAlloy woven mesh burner, mounted in a vertical orientation.
2. The burner must be capable of firing at both a complete blue flame with maximum gas and air input as well as firing infrared when gas and air are reduced. The burner must be capable of firing at 100% of rated input when supplied with 4.0" WC of inlet gas pressure, so as to maintain service under heavy demand conditions; no exceptions.
3. The burner shall use a combustion air blower to precisely control the fuel/air mixture for maximum efficiency throughout the entire range of modulation. The combustion air blower shall operate for a pre-purge period before burner ignition and a post-purge period after burner operation to clear the combustion chamber.
4. The blower shall infinitely vary its output in response to a 4-20 mA signal supplied directly from the PID modulating temperature controller, thereby electronically and precisely adjusting the volume of air and gas supplied for combustion. Minimum fire shall be 25 percent of rated input.

F. Pilot Control System

1. The boiler(s) shall be equipped with a 100 percent safety shutdown.
2. The ignition shall be Hot Surface Ignition type with full flame rectification by remote sensing separate from the ignition source, with a three-try-for-ignition sequence, to ensure consistent operation.
3. The igniter will be located to the side of the heat exchanger to protect the device from condensation during start-up.
4. The ignition control module shall include an LED that indicates six (6) individual diagnostic flash codes.
5. An external viewing port shall be provided, permitting visual observation of burner operation.

G. Gas Train

1. The boiler(s) shall have dual-seated main gas valve.
2. Gas control trains shall have a redundant safety shut-off feature, main gas regulation, shut-off cock and plugged pressure tapping to meet the requirements of ANSI Z21.13/CSA 4.9.

H. Boiler Control

1. The following safety controls shall be provided:
 - a. High limit control with manual reset.
 - b. Flow switch, mounted and wired.
 - c. 60 PSIG ASME pressure relief valve, piped by the installer to an approved drain.

- d. Temperature and pressure gauge (shipped loose).
- I. Firing Mode: Provide electronic modulating control of the gas input to the boiler.
- J. Boiler Diagnostics
 - 1. Provide external LED panel displaying the following boiler status/faults:
 - a. Power on – Green
 - b. Call for heat – Amber
 - c. Burner firing – Blue
 - d. Service – Red
 - 2. Provide internal circuit board indicating the following safety faults by a 2 line, 20 character, LCD display:
 - a. System status
 - b. Condensate blockage
 - c. Manual reset high limit
 - d. Auto reset high limit (optional)
 - e. Low water cut-off (optional)
 - f. Blocked vent
 - g. Low gas pressure switch (optional)
 - h. High gas pressure switch (optional)
 - i. Controller alarm
 - j. Flow switch
 - k. Air pressure
 - l. Factory option
 - m. External interlock
 - n. Cold Water Start/Cold Water Run
 - o. Ignition lock-out
 - 3. Provide ignition module indicating the following flash codes by LED signal and displayed on LCD display:
 - a. 1 flash – low air pressure
 - b. 2 flashes – flame in the combustion chamber w/0 CFH
 - c. 3 flashes – ignition lock-out (flame failure)
 - d. 4 flashes – low hot surface igniter current
 - e. 5 flashes – low 24VAC
 - f. 6 flashes – internal fault (replace module)
- K. Combustion Chamber: The combustion chamber wrapper shall be insulated to reduce standby radiation losses, reducing jacket losses and increasing unit efficiency.
- L. Cabinet
 - 1. The corrosion-resistant galvanized-steel jackets shall be finished with a baked-on epoxy powder coat, which is suitable for outdoor installation, applied prior to assembly for complete coverage, and shall incorporate louvers in the outer panels to divert air past heated surfaces.
 - 2. The boiler(s), if located on a combustion air and flue products through the back of the unit.
 - 3. The boiler(s) shall connect both the combustion air and flue products through the back of the unit.
 - 4. The boiler shall have as standard an internal, combustion air filter rated to MERV 8 (>95% arrestance).
- M. Boiler Pump – The boiler(s) shall be equipped with a factory-packaged pump system.
- N. Cold water protection system shall be configured with two variable-speed pumps that are controlled by a system-matched PID control that injects the correct amount of cold water directly into the boiler loop to maintain the required minimum inlet temperature. The PID controller temperature sensor shall be located in the inlet header of the boiler.

2.10 BOILER OPERATING CONTROLS

- A. The boiler(s) shall feature a modulating digital controller with selectable outdoor reset mode option, mounted and wired.
- B. System sensor and optional air temperature sensor shall be shipped loose for field installation by installing contractor. Inlet/Outlet sensors are factory-installed.

2.11 DIRECT VENT

- A. The boiler(s) shall meet safety standards for direct vent equipment as noted by the 2006 Uniform Mechanical Code, section 1107.6, and ASHRAE 15-1994, section 8.13.6.

2.12 SOURCE QUALITY CONTROL

- A. The boiler(s) shall be completely assembled, wired, and fire-tested prior to shipment from the factory.
- B. The boiler(s) shall be furnished with the sales order, ASME Manufacturer's Data Report(s), inspection sheet, wiring diagram, rating plate and Installation and Operating Manual.

PART 3 - EXECUTION

3.01 INSTALLATION AND CONNECTION

- A. Installation and connection of gas-fired units and associated fuel and vent features and systems shall be in accordance with NFPA 54, applicable local codes and regulations, and manufacturer's published installation instructions.
 - 1. Connect gas piping in accordance with Section 23 11 00 - "NATURAL GAS PIPING SYSTEMS."
- B. Controls: Conform to Section 25 50 00 - "CONTROLS AND INSTRUMENTATION."
- C. Connect piping in accordance with Section 23 21 13 - "HYDRONIC PIPING."

3.02 EQUIPMENT INSTALLATION

- A. Set or hang all mechanical equipment square with building lines, level and at elevations required to clear other work. Secure properly, in accordance with the equipment manufacturer's instructions. Set units so as to allow sufficient clearance for proper installation of all piping, power and control wiring and work of any other contractor.
- B. Provide a 4" concrete housekeeping pad under all boilers and base-mounted pumps. Coordinate size and location as required to match equipment layout.
- C. Install pumps in accordance with details on drawings, including all valves, gauges, vibration isolation couplings, etc. as shown. Lay out piping in advance of pump placement to assure adequate space for all fittings, valves, and trim. Recheck motor alignment after installation.

3.03 COMMISSIONING

- A. Test functions, operations, and control sequences and protective features. Adjust to assure operation is in accordance with specification.
- B. Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.04 CLEANING AND ADJUSTING

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".

END OF SECTION 23 52 33

SECTION 23 75 00 - AIR HANDLING EQUIPMENT**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 4. General Conditions. |
| 2. General Provisions of the Contract. | 5. Supplementary Conditions. |
| 3. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. This Section includes units and accessories listed below, complete with the required controls and electrical equipment necessary for operation.
- | | |
|--------------------|------------------------|
| 1. Vav Boxes. | 3. Blower coil units. |
| 2. Fan-coil units. | 4. Air Handling Units. |

1.03 SOURCE

- A. All VAV boxes are OFCI (owner furnished, contractor installed).

PART 2 - PRODUCTS

2.01 CONTROLS FOR AIR HANDLING EQUIPMENT

- A. Control Components
1. Control shall be full "DDC" thru a Terminal Unit Controller, unless otherwise called for on drawings. See control system specifications for requirements. As a minimum a fused control circuit transformer, motor starter(s), and single-point wiring connection terminal strips shall be factory installed with the Terminal Unit Controller. Refer to drawings for additional requirements.
 2. In all cases controls shall include an appropriate motor starter equipped with overload relays. Provide a suitable enclosure for the motor starter if it is not housed within the unit. Provide 24 volt coil and a 24 volt control circuit transformer.
 3. Electronic damper operator motors shall be furnished for all dampers in air handling equipment. Motors shall be factory mounted and wired.

202 FINISHES

- . External Casings and Cabinets: Baked enamel over corrosion-resistant treated surface, or galvanized steel.

PART 3 - EXECUTION

3.01 INSTALLATION AND CONNECTION

- A. Installation and connection of units and systems shall be in accordance with applicable local codes and regulations, and manufacturer's published installation instructions.
- B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level. Provide all required miscellaneous framing for proper attachment to structure.
- C. Controls: Conform to Section 25 50 00 - "CONTROLS AND INSTRUMENTATION."
- D. Connect ducts in accordance with Section 23 30 00 - "AIR DISTRIBUTION."

3.02 COMMISSIONING

- A. Test functions, operations, and control sequences and protective features. Adjust to assure operation is in accordance with specification.
- B. Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- C. Environmental Requirements
 - 1. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
- D. Extra Stock
 - 1. Provide one complete extra set of disposable filters for all air handling equipment on the project.
 - 2. Provide a complete list of the required filters for the owner's use.

3.03 CLEANING AND ADJUSTING

- A. Cleaning: Upon completion of installation, inspect units and associated components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
- B. Adjusting: Make control, fan speed, and other adjustments for optimum performance and efficiency. Verify proper drainage of condensate.

END OF SECTION 23 75 00

SECTION 23 81 26 - CONDENSING UNITS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Conditions.
 3. General Provisions of the Contract.
 4. Supplementary Conditions.
 5. Solicitation Documents.
 6. Architectural Division.

1.02 WORK INCLUDES

- A. Air-cooled condensing units.

1.03 RELATED WORK

- A. Section 20 01 00- "GENERAL PROVISIONS". B. Section 23 23 00 - "REFRIGERANT PIPING".
C. Section 20 03 00 - "MATERIALS AND METHODS".
D. Section 26 00 10 - "BASIC ELECTRICAL REQUIREMENTS".

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories; and installation and start-up instructions.
- B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation of condensing units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- C. Operation and Maintenance Data: Submit maintenance data and parts list for each condensing unit, control, and accessory; including "trouble shooting" maintenance guide; plus servicing, and preventative maintenance procedures and schedule. Include this data and product data in maintenance manual; in accordance with requirements of Architectural Division.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of condensing units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
1. Capacity ratings for condensing units shall be in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".
 2. Refrigeration system of condensing units shall be constructed in accordance with ASHRAE Standard ASHRAE 15 "Safety Code for Mechanical Refrigeration".
 3. Condensing units shall meet or exceed the minimum COP/Efficiency levels as prescribed in ASHRAE 90A "Energy Conservation in New Building Design".
 4. Condensing units shall be listed by UL and have UL label affixed.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle condensing units and components carefully to prevent damage. Follow manufacturer's written instructions for rigging. Replace damaged condensing units or components.
- B. Store condensing units and components in clean dry place off the ground. Protect from weather, water, and

physical damage.

1.07 SPECIAL PROJECT WARRANTY

- A. Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
1. Warranty Period: 5 years from date of substantial completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- | | |
|---|--|
| A. Carrier Air Conditioning; Div. Carrier Corp. | B. Trane (The) Co; Div American Standard, Inc. |
| C. Lennox Industries, Inc. | D. York; Div. York International. |
| E. Mitsubishi. | |
| F. The condensing units shall be of the same manufacturer as the furnaces specified in section 23 54 16. | |
| G. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F. | |

2.02 AIR-COOLED CONDENSING UNITS

- A. Factory-assembled and tested air-cooled condensing units, consisting of compressors, condenser coil, fans, motors, refrigerant reservoirs, and operating controls. Capacity and electrical characteristics are scheduled on the drawings.
- B. Casing: Galvanized steel finished with baked enamel, complete with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Unit shall be complete with brass service valves, fittings, and gauge ports on exterior of casing.
- C. Compressors: Semi-hermetic rebuildable compressors with built-in overloads and vibration isolation. Compressor motor shall have thermal sensitive overload devices, internal high- pressure protection, high and low pressure cutout switches, start relay, contactor, crankcase heater, and timer to prevent compressor rapid cycle.
- D. Refrigerant: 410a.
- E. Condenser: Coil shall have copper tubes and aluminum fins, complete with liquid accumulator and liquid subcooler. Aluminum propeller fans shall be direct driven, with permanently lubricated fan motor having thermal overload protection.
- F. Accessories:
1. Head pressure control to modulate condenser fan motor speed for low ambient conditions (where specified).
 2. Low-voltage control transformer.
 3. Coil Guards or equivalent unit casing.
 4. Provide locking-type tamper-resistant caps on all refrigerant circuit access ports.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify roof structure, mounting supports, and membrane installations are completed to the proper point to allow installation of roof mounted units. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install condensing unit in accordance with manufacturer's installation instructions. Install unit plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support:
 - 1. Install ground-mounted unit on 4" thick reinforced concrete pad, 4" larger on each side than condensing unit. Concrete is specified in Architectural Division. Coordinate installation of anchoring devices.

3.03 FIELD QUALITY CONTROL

- A. Testing:
 - 1. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

3.04 DEMONSTRATION

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".

END OF SECTION 23 81 26

SECTION 25 50 00 - CONTROLS AND INSTRUMENTATION**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. This Section includes all HVAC controls, and accessories for a complete electric electronic temperature control system within the building.
- B. Provide as herein specified, a complete electric electronic temperature control system. The control system shall be installed by competent control mechanics and electricians regularly employed by the manufacturer of the control equipment. The control system shall consist of all thermostats, temperature transmitters, controllers, automatic dampers, damper operators, switches, control panels and other accessory equipment along with a complete system of electrical wiring to fill the intent of the specification and provide for a complete and operable system. All wiring and conduit shall comply with requirements of Division 26.
- C. The contractor shall furnish and install controls as indicated on the drawings for the purpose of automatically controlling each HVAC system. This contractor shall acquaint himself with the desired sequence of control, and it shall be his responsibility to bring about this result. It is required that all controls on this project be furnished and installed by a controls subcontractor.
- D. The control system must be installed by an experienced controls subcontractor who is regularly engaged in installations of similar size and description in his normal course of business, and has existing installations that have been fully operational for a period of not less than three years. Proof of such installations may be required prior to contract approval by the Owner.
- E. The system shall be provided with internal or external battery power or other suitable means to prevent loss of programming or setpoints during power outages to the building. The system shall be capable of experiencing a loss of power up to 96 hours in duration without requiring service for restarting or reprogramming. Restarting shall be fully automatic.

1.03 RELATED WORK

- A. Section 20 03 00 - "MATERIALS AND METHODS".
- B. Section 20 09 23 - "DIGITAL ELECTRONIC SYSTEM." (if applicable)

1.04 SUBMITTALS

- A. Prior to any fabrication, ordering, or installation work, complete submittals and shop drawings for the control system shall be made. The submittal shall include the following:
1. Control wiring and program logic diagrams (preferably CAD drawings).
 2. Complete manufacturer's data sheet on each control device to be used.
 3. Pictorial representation of each room sensor or other control to be installed within the occupied spaces.
 4. Actual sample of each thermostat, room sensor, and control device to be installed in the occupied spaces. Covers, guards, etc. shall be included (These can subsequently be used on the project).
- B. Actual sample submittals shall be brought or sent to the Engineer's office directly. Other submittals shall be made in the normal manner via the general contractor and architect.

1.05 SYSTEM DESCRIPTION

- A. The system shall be electronic and electric as indicated in the control diagram. Exact duplication of the arrangements shown in the diagram is not required. System design is the responsibility of the controls

subcontractor, and he shall arrange the system to accomplish the objectives of control which are indicated by the diagrams and the sequence of operation herein.

1.06 ELECTRIC WIRING

- A. Control wiring, regardless of voltage, is the responsibility of the controls subcontractor, including all conduit and outlet boxes for controls. All line voltage and low voltage control wiring shall be installed in accordance with the requirements of the Electrical Specifications. No control wiring shall be installed inside any duct. In general, ceiling spaces on this project shall be considered to be air handling unless otherwise designated.
- B. Control wiring which operates at more than 24 volts nominal shall be copper wire installed in EMT conduit. Low voltage control wiring in accessible locations above ceilings may be jacketed plenum cable. No non-plenum-rated wire shall be used. No wire smaller than 18 gauge shall be used. Such wiring shall be neatly strapped in place with plastic wire ties. Attach wiring to top chords of bar joists top rows of joist bridging, or other framing members. Do not attach to or lay on ceilings or bottom chords of bar joists. Low voltage wiring where exposed to view shall be installed in EMT conduit.
- C. Outlet boxes or other recessed enclosures for control wiring shall be installed as indicated and the contractor shall assure that the proper boxes are available in time to avoid delaying the masonry work or other trades.
- D. Line voltage wiring which provides power to the main motor of any piece of HVAC equipment, including manual switch wiring, is considered power wiring and is specified under the electrical work. Circuits to motorized dampers are control wiring.
- E. Control diagrams are the responsibility of the HVAC contractor. At the completion of the job, all diagrams shall be provided to the Owner along with the equipment operating and maintenance instructions, see Section 20 01 00 - "GENERAL PROVISIONS."
- F. Where control wiring must be routed in masonry walls (such as to thermostats) it shall be installed in conduit. Assure that conduit and boxes are placed in time to avoid delaying masonry work.
- G. Power for control devices and panels shall originate within the equipment being controlled. The control subcontract shall in all cases provide for connection to such power, and provide for any necessary control circuit transformer including fusing and disconnect switch. No separate electrical circuits will be provided for control equipment or panels by the electrical contractor except as may be specifically shown on the drawings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. See Section 23 09 23.
- B. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 CONTROL DEVICES

- A. Thermostats, room sensors, temperature controllers, damper motors, relays, switches, and all other control devices shall be provided as required to achieve the control sequences called for. All control system elements require the Engineer's approval of submittals. All equipment and devices used shall be of first quality, the best offered by the control system being used.
- B. Provide guards for thermostats as noted on the drawings.

PART 3 - EXECUTION

3.01 CONTROL DEVICES

- A. All thermostats, room sensors, override buttons, and other control devices which are adjustable by the occupants of the building, shall be mounted so as to meet ADA (Americans with Disabilities Act) accessibility requirements. Mount devices 48" AFF to the bottom of the device unless a conflict occurs. Where the 48" location is obstructed by a light switch, counter, or other item, the height may be increased to 54", but only in locations where the control can be operated by a "side reach" from a wheelchair. If this adjustment will not

resolve the conflict, report it to the engineer for resolution.

- B. Control devices and room sensors which are not in any way adjustable by the occupants of the building shall be mounted at 60" above finished floor, unless otherwise designated on the drawings.
- C. Transformers, control modules, and motor interface devices shall be mounted in a suitable panel or enclosure adjacent to or within HVAC equipment.
- D. Install room thermostats furnished with duct coils and unit heaters, wire, test and calibrate controls.

3.02 CONTROL HARDWARE INSTALLATION

- A. Terminal control units shall be preferably mounted on the HVAC equipment and fully wired prior to hanging installation of the equipment. Mounting and wiring in the ceiling space will not be permitted. Preferably, the units should be mounted and wired at the manufacturer's plant prior to shipment. If this cannot be done, they shall be mounted and wired at the HVAC contractor's shop or at a central, well-organized temporary work location inside the building.
- B. Each terminal unit shall be checked to verify proper function prior to the unit's installation in the building.
- C. The complete control system shall be programmed and started in operation by its installers.

3.03 CONTROL SEQUENCES

- A. Control sequences shall be as indicated on the drawings or as required to accomplish reasonable control of the equipment shown on the drawings. No HVAC device shall be left without control.
- B. Each terminal unit shall be checked to verify proper function of its controls as part of the start-up process.
- C. Unit controllers shall be pre-programmed with sequences prior to installation on the project. Such sequences shall be resident within each controller and shall not be lost due to power outages, etc.

3.04 HVAC SYSTEM TRAINING

- A. See Section 20 02 00 - "Contract Close-Out and Commissioning"

3.05 EQUIPMENT LABELING

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".

3.06 FINAL ADJUSTMENT OF CONTROLS

- A. See Section 20 02 00 - "Contract Close-out & Commissioning".
- B. After approximately 6 months use of the building, the controls subcontractor shall visit the building and check all functions of the controls, make any adjustments which may be made necessary by the change in seasons, and review the system's operation with the Owner's representative.

END OF SECTION 25 50 00

SECTION 26 00 10 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Architectural Division. |

1.02 SUMMARY

- A. This Section includes requirements for electrical installations. The following requirements are included in this Section to expand the requirements specified in Architectural Division:
- | | |
|-------------------------|------------------------------|
| 1. Submittals. | 2. Rough-ins. |
| 3. Record documents. | 4. Electrical installations. |
| 5. Maintenance manuals. | 6. Cutting and patching. |

1.03 WORK INCLUDES

- A. The work to be performed under this Division shall include all labor, materials, equipment, transportation, and facilities necessary to provide a complete and satisfactory system ready to use. Wherever the words "the Contractor" or "this Contractor" appear in this Division, they refer to the Contractor for the work specified in that Section. This Contractor shall examine all Drawings and all Sections of the Specifications and shall be responsible for ascertaining to what extent other Drawings and Sections affect the work herein specified.
- B. Unless noted on the drawings otherwise, work shall also include:
1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
 2. All utility company charges associated with utility services for the project.
 3. All fees and direct expenses involved in any inspection required for the project.
 4. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
 5. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
 6. All lights, guards, and signs as required by safety regulations applicable to the work.
 7. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.
- C. The work shall include revisions, modifications, and rework of existing work as required for installation of new work and as required for connections of new work to existing systems, and as required for connections of existing work to new systems.

1.04 CODES, REGULATIONS, AND STANDARDS

- A. All work must be performed in accordance with the requirements of local, county, state and national codes and regulations including the requirements of the following:
1. International Building, Mechanical, & Plumbing Codes, Latest Editions.
 2. National Electrical Code.
 3. Occupational Safety and Health Act. of 1970.
 4. Life Safety Code, N.F.P.A. No. 101.
 5. NFPA 17/17A, 72, 72E, 54, and 96.
 6. For work not specifically listed above, use standards and codes of the National Fire Protection Association.

1.05 ABBREVIATIONS

- A. All equipment, apparatus and systems shall be rated, tested, fabricated and/or installed in accordance with the applicable industry standard mentioned. The following list will serve to clarify abbreviations that appear in other sections of this specification:

1. AABC Associated Air Balance Council
2. ADC Air Diffusion Council
3. ANSI American National Standards Institute
4. ASE Association of Safety Engineers
5. ASTM American Society for Testing and Materials
6. EPA Environmental Protection Agency
7. IEEE Institute of Electrical and Electronics Engineers
8. NEMA National Electrical Manufacturers Association
9. NFPA National Fire Protection Association
10. NSC National Safety Council
11. UL Underwriters Laboratories

1.06 SUBMITTALS

- A. See also Architectural Division Section "SUBMITTALS" for requirements for submittals, shop drawings and product data.
- B. As soon as possible and within thirty (30) days after the award of the contract and before beginning the fabrication of any material or the installation of any equipment, a complete schedule of the materials and equipment proposed for installation shall be submitted to the Engineer for approval. This schedule shall include manufacturers' names, catalog data, diagrams, drawings and other descriptive data as required or requested by the Engineer.
- C. Submittals shall be assembled in an orderly manner and shall include a title page with space for the Engineer's approval stamp and remarks. It shall also contain a concise listing of all items being submitted. Refer to general conditions of the specifications for format and number of copies required.
- D. Asbestos Free Material/Product: Prior to approval of the material/product to be used, the manufacturer/supplier shall furnish the Engineer with written certification that the material/product contains no asbestos. This certificate is mandatory before approval will be issued. Submittals furnished without the asbestos-free certification will be returned to the Contractor with no action taken until such certification is provided.

1.07 SUBSTITUTION OF EQUIPMENT

- A. All proposed substitutions for specified products on this project (except as listed above) require approval in advance of bidding. Approval will not be granted after award of contract. See Section 16000, Part 4 - Substitution Request Form. If no form is found, submit by mail, or hand-carried on contractor's or supplier's letterhead. **DO NOT FAX.** Substitutions must be submitted for review five (5) working days prior to the bid date to be considered.
- B. It is incumbent on the Contractor to submit technical data that will fully establish the equality of the proposed substitute equipment with that listed and evidence to substantiate the availability of the required repair and maintenance service. Each request for substitution shall be accompanied by the following information for each piece of equipment:
 1. Statement indicating that this substituted equipment will not increase the contract cost nor extend the completion date.
 2. Manufacturer's name and model number.
 3. Catalog cuts, diagrams and other data published by the manufacturer with the particular model identified and the pertinent design data for that model highlighted or underlined for easy reference.
 4. Each request for substitution shall also include the following information relating to service maintenance and repair:
 - a. Name, address and telephone number of nearest factory authorized technical representative.
 - b. Name, address and telephone number of firm(s) qualified to perform preventive maintenance, minor or major repairs in the locale of the project.
 - c. Name, address and telephone number of firm(s) from whom spare parts and major components are available.
 - d. Building name and address, and the name, address and telephone number of its owner's representative where equipment of the same manufacturer as that requested for substitution has been installed and in operation for two or more years. Two or more such installations shall be listed and the location should be in the vicinity of the proposed project.

- C. In the event of Engineer's approval of a substitution of equipment, the requestive entity will be notified by telephonic message or FAX by the Engineer (or authorized representative), and/or by the issuance of an amendment to the contract documents incorporating the equipment by name and model number.

1.08 CONTRACT DRAWINGS

- A. The layout shown on the Contract Drawings is necessarily diagrammatic but shall be followed as closely as actual construction and as other work will allow. The dimensions of work as shown on the Contract Drawings are not as-built dimensions. No measurements shall be scaled from the drawings and used as definite dimensions for laying out or fitting work in place.
- B. The layout of manufactured equipment as shown on the drawings shall be checked and the exact location shall be determined from the dimensions of equipment shop drawings approved by the Engineer.

1.09 MAINTENANCE MANUAL AND OPERATING INSTRUCTIONS

- A. See Section 26 00 20 - "Contract Close-out & Commissioning".

1.10 PROJECT RECORD AND CLOSEOUT DOCUMENTS

- A. See Section 26 00 20 - "Contract Close-out & Commissioning".

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver equipment in time to maintain approved construction schedule.
- B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- C. Store in safe, dry location. Protect from dust, moisture, weather and extreme temperatures.
- D. Follow manufacturer's recommendation for transportation, handling and storage.

1.12 GUARANTEES AND WARRANTIES

- A. Submit to the Owner, two copies of all warranties and guarantees specified in the General Conditions, Supplementary Conditions, the individual sections of the specifications, or as provided by the various subcontractors and material suppliers. All such documents shall show the name and location of the project and the name of the purchaser.
- B. This Contractor shall provide to the Owner a non-prorated guarantee of all materials and workmanship for a period of not less than one year from the date of the Owner's final certificate.
- C. This Contractor shall be responsible for enforcing all special or extended guarantees required in individual sections of the specifications that might be provided by various subcontractors or material suppliers.
- D. Acceptance of the work under this Division shall be subject to the conditions that all installed systems, equipment, apparatus, and appliances included in the work shall operate and perform as designed, including code clearances, and as selected with respect to efficiency, capacity and quietness and shall operate and perform without producing objectionable noise within occupied areas of the building.
- E. Acceptance of the work shall also be subject to the conditions that any time within one year after date of final payment, any defective part of the work resulting from the supply of faulty workmanship or material shall be immediately amended, repaired or replaced as a part of the contract work without cost to the Owner.
- F. This guarantee shall be extended to include the capacity and integrated performance of the component parts of the various systems in strict accordance with the true intent and purpose of the specification. The contractor shall conduct such tests as herein before specified or as may be required by the Engineer to demonstrate the capacity and performance ability of the various systems to maintain specified conditions.
- G. Exclusions: lamps furnished by the Contractor shall be guaranteed for their rated life, not to exceed one year from the date of final acceptance. Lamps failing to meet the rated life shall be replaced by the Contractor. Replacement lamps shall be furnished to the Owner and installation of the replacement lamps shall be by the Owner.

1.13 ROCK EXCAVATION

- A. If the "Form of Proposal" contains a rock clause with prices to be paid for rock excavation, then material to be excavated is assumed to be earth and/or other materials that can be removed by $\frac{3}{4}$ cubic yard shovel without drilling and blasting or wedging and rock excavation shall be paid for at the prices quoted in the "Form of Proposal". If the "Form of Proposal" contains no rock clause or contains the statement that excavation is unclassified, then excavation of all material must be included in the base bid regardless of the type of material. Trenches shall be excavated to the point two (2) inches below the bottom and 8" outside of the pipe(s) (not less than 24" width). If there is payment under a rock clause, then the quantity shall be based on these required dimensions of trench excavation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 33 through 26 for rough-in requirements.

3.02 ELECTRICAL INSTALLATIONS

- A. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate electrical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 11. Install access panel or doors where units are concealed behind finished surfaces.
 12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.03 GROUNDING

- A. All branch circuits on the project shall have an equipment grounding conductor routed with the circuit conductors. This means that all conduits must have a "green" wire installed in them and sized in accordance with table 250-122 of the NEC (latest edition).

- B. Dependence on the conduit system for grounding is not acceptable.

3.04 DEFECTIVE WORK AND MATERIAL

- A. All materials or work found to be defective or not in strict conformity with the drawings or different from requirements of the drawings and specifications or defaced or injured through negligence of Contractor or his employees, or through action of fire or weather will be rejected and shall be immediately removed from premises by Contractor and satisfactory materials and work substituted without delay.
- B. All defective work or imperfect work shall be corrected immediately on notice from Engineer. No previous inspection or certificate on account shall be held to relieve Contractor from his obligation to furnish sound materials and to perform good and satisfactory work.

3.05 COOPERATION AND COORDINATION

- A. Contractor shall confer with other contractors at the site before installing his work to avoid interferences so that maximum head room and clearances may be maintained. In event that interferences develop between work of various contractors, Engineer's decision will be final and no additional compensation will be allowed for changes required.
- B. Particular attention shall be paid to situations where recessed equipment, pipes and lights occur, or where the work of several trades occurs together above suspended ceilings, in pipe shafts or in areas where space is limited.
- C. All fixtures, equipment, devices, switches, outlets, pumps, etc., shall be positioned to avoid all interferences with and to assure proper coordination with work of all other trades, cases, partitions, wall, floor and ceiling patterns, architectural features, etc. All recessed devices, fixtures, etc., shall be coordinated with all wall, floor and ceiling patterns. Engineer will reconcile conflicts and adjustments where such adjustments are warranted.

3.06 CUTTING AND PATCHING

- A. Perform cutting and patching in accordance with Architectural Division Section "CUTTING AND PATCHING." In addition to the requirements specified in Architectural Division, the following requirements apply:
 - 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work.
 - 2. Remove and replace defective work.
 - 3. Remove and replace work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed work as specified for testing.
- C. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 1. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
 - a. Refer to Architectural Division Section "DEFINITIONS AND STANDARDS" for definition of "experienced Installer."

PART 4 - SUBSTITUTION REQUEST FORM

MAIL TO: Smith-Goth Engineers, Inc.
(NO FAX ACCEPTED) 3855 South Jefferson Ave.
Springfield, Missouri 65807

PROJECT: _____

(THIS FORM MUST BE RECEIVED BY 5 WORKING DAYS PRIOR TO BID DATE IN ORDER TO BE CONSIDERED)

SECTION: _____ PARAGRAPH: _____ SPECIFIED ITEM: _____ PROPOSED SUBSTITUTE: _____

Attach a complete description, designation, catalog or model number, Spec Data sheet, and other technical data, including laboratory tests if applicable.

Fill in blanks below:

1. Will substitution affect dimensions indicated on drawing? _____

2. Will substitution affect wiring, piping, ductwork, etc. indicated on drawings? _____

3. What affect will substitution have on other trades? _____

4. Differences between proposed substitution and specified item? _____

5. If necessary, will the undersigned pay Owner for Engineering costs required to revise the working drawings caused by the substitution? _____

6. Manufacturer's warranties of the specified items and proposed items are: Same Different (explain) _____

7. Submitted By:
Firm _____
Address _____ Phone: _____
City/State: _____ Fax: _____
Signature: _____ Date: _____

Remarks: _____

Review Comments: Accepted Accepted as noted Not Accepted Received too late

By: _____ Date: _____

Remarks: _____

END OF SECTION 26 00 10

SECTION 26 00 20 - CONTRACT CLOSE-OUT & COMMISSIONING**PART 1 - GENERAL (NOT USED)**

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 MAINTENANCE MANUAL AND OPERATING INSTRUCTIONS (26 00 10)

- A. Upon completion of the work, Contractors shall provide the Engineer with two copies of maintenance manuals or one electronic copy of all equipment furnished and installed under his work. Prepare maintenance manuals in accordance with Architectural Division Section "Project Closeout" and the following paragraphs.
- B. Manuals shall be in substantial 3-ring binders or in electronic format (pdf) with project name and number inscribed on face and hinged back. Manuals shall include roster of all training session attendees. The manuals shall, however, first be approved by the Engineer. The manuals shall include, but not be limited to manufacturer's operating instructions and parts list and serial numbers for all operating machinery, including drive information, and motor horsepower, amperage, and voltage readings on all phases, sequence of operation, index following the order listed in the specifications, warranties in the name of the Installation, and a list of manufacturers, service firms and subcontractor's names and telephone numbers.
- C. Training attendance rosters for each training session shall be included in manuals. Roster will identify training subject, date, attendees name, job title, and telephone number.
- D. All switches, controls, and safety devices shall be clearly and permanently marked with embossed or printed plates as to purpose and as to operation and shall be tested in the presence of the Owner designated representative to ensure that he understands their function and purpose.
- E. Upon completion of the work, Contractors shall put the systems into service. Contractors shall be entirely responsible for the equipment during all testing operations including the lubricating and turning on and off of such apparatus.

3.02 PROJECT RECORD AND CLOSEOUT DOCUMENTS (26 00 10)

- A. See Architectural Division Section "RECORD DOCUMENTS" for red lining of all documents during construction to reflect "as-built" conditions.
- B. In addition to the requirements specified in Division 1, indicate the following installed conditions:
 - 1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
 - 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

3.03 FIRESTOPPING

- A. Where conduits and/or electrical devices penetrate fire-rated walls, floors, and any other fire rated assembly the cavity shall be sealed with intumescent material capable of expanding 5 to 10 times when exposed to temperatures of 250° F. It shall be IBC, BOCA, and SBCCI (NRB 243) approved ratings per ASTM E-814 (U.L. 1479). Acceptable materials: DOW-CORNING 3-6548 silicone RTV foam or 3-M fire barrier caulk, or 3-M fire barrier 2001 silicone RTV foams.
- B. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining surfaces.
- C. Identification
 - 1. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system

installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

- a. The words: "Warning-Through-Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage"

3.04 WIRES & CABLES FIELD QUALITY CONTROL (26 05 19)

- A. Inspect wiring for physical damage and proper connection.
- B. Torque test conductor terminations to manufacturer's recommended values.
- C. Perform continuity test on all power and branch circuit conductors. Verify proper phasing.

3.05 ELECTRICAL EQUIPMENT IDENTIFICATION PLATES (26 05 53)

- A. Provide plates for each piece of electrical equipment consisting of machine engraved laminated plastic. Plate field shall be black with white core.
- B. Provide engraved plastic nameplates for each switch or circuit breaker in each main panel, for each panelboard, and for each safety switch. Indicate type of load and maximum fuse size. Provide schedule of nameplates with submittals.
 1. Size of plate shall be commensurate with lettering thereon.
 2. Lettering for major items of equipment, such as a disconnect or panelboard, shall be ½" in height. Lettering for smaller items, such as light or timer switches shall be ¼" in height.
 3. Wording on plate shall contain the following information as appropriate and approved by the Engineer.
 - a. Equipment served, such as AHU-1.
 - b. Originating or controlled circuit number, such as AL 1, 3, & 5.
 - c. Voltage.
 - d. Maximum fuse size (if applicable).

3.06 CONDUIT SYSTEM IDENTIFICATION (26 05 53)

- A. Identify all fire alarm system components, except those concealed in walls.
 1. Conduit: 2" wide red tape or paint strip 50' on center.
 2. Fire Alarm Conduit Boxes: Red paint cover with stenciled words "FIRE ALARM".

3.07 WIRING SYSTEM IDENTIFICATION (26 05 53)

- A. Control wiring may use numbered or lettered marker tape. Record wiring so marked on project record documents. Marker tape shall be 3M Scotch Code, Panduit Insta-Code, T & B E-Z Coder, Stranco Tuff-Code, Bradypack or Electrovert.

3.08 LIGHT FIXTURES (26 50 00)

- A. Remove all dirt, paint, and foreign matter from fixture lenses and frames between substantial completion and final acceptance of the building.
- B. Remove all labels from lenses or other areas visible in the completed installation.

3.09 FIRE ALARM SYSTEM INSTRUCT OWNER'S PERSONNEL (28 31 00)

- A. Provide one 3 hour seminar for instruction of 4 personnel in the operation of the system. Seminar shall be conducted by manufacturer's representative.

3.10 FIRE ALARM SYSTEM CERTIFICATION (28 31 00)

- A. System shall be thoroughly tested by the manufacturer's representative. Testing shall be performed in the presence of the local Fire Department Representative. Contractor shall notify Engineer prior to testing. Contractor shall issue a written certification statement that all equipment has been installed in accordance with plans and specifications and also manufacturer's wiring diagrams, instructions, and directions. Certification shall state that the system is in complete proper operating order.

3.11 TESTING SUBMITTALS (26 01 26)

- A. Test Reports: Submit copies of all test reports to Engineer per Division 1 requirements.
 - 1. Type each test report on 8- 1/2 inch x 11 inch paper. Include:
 - a. Project Number.
 - b. Project title and location.
 - c. Test performed.
 - d. Date performed.
 - e. Test equipment used.
 - f. Contractor's name, address and telephone number.
 - g. Testing firm's name, address and telephone number if other than Contractor.
 - h. Name (s) and title (s) of person (s):
 - 1) Performing test
 - 2) Observing test.
 - i. Statement verifying each test.
 - j. Nameplate data from each equipment item tested.
 - k. Test results.
 - 1) Retest results after correction of defective components, systems.
 - 2) For each copy, assemble all test reports and bind them in a folder. Label each folder, "Electrical Test Reports".
 - 3) Comply with Division 26 Section 26 00 10 "SUBMITTALS".

3.12 CONTINUITY TESTS (26 01 26)

- A. Test branch circuits and control circuits to determine continuity of wiring and connections.

3.13 VOLTAGE TESTS (26 01 26)

- A. Make and record voltage tests and recorded at the following listed points. Conduct tests under normal load conditions.
 - 1. Service entrance at main switchboard.

3.14 TESTING PHASE RELATIONSHIP (26 01 26)

- A. Examine connections to equipment for proper phase relationships. Verify proper motor rotation.

3.15 FIRE ALARM ACCEPTANCE TEST (26 01 26)

- A. Have the fire alarm acceptance test performed by the Alarm Company Representative and installing Contractor in the presence of the local fire chief's representative.

B. Acceptance Test Procedures:

<u>EXPECTED INDICATION ON PANEL</u>	<u>PREMISES & REMOTE STATION</u>
1. Normal Power to Panel	(Normal)
2. Disconnect Power to Panel	(Trouble)
3. Activate Detection Device	(Alarm)
4. Silence Alarm Signaling Devices	(Trouble)
5. Return Normal Power to Panel & Reset Panel	(Normal)
6. Place Each Function Switch in an Abnormal Position.	(Trouble)
7. Remove supervised Devices from System (During this portion of testing, ensure proper wire has been used and devices are properly installed.	
8. Return Supervised Device to System.	
9. Disconnect Normal Power to Panel.	(Normal)
10. Activate Detector(s) for each Zone.	(Alarm)
11. Inspect all Horns Zone Indication, and Auxiliary Devices.	(Working List)
12. Silence Horns.	(Alarm/Trouble)

- 13. Reset System. (Trouble)
- 14. Return Normal Power to System (Normal)
- 15. Place Panel in Alarm Condition. Disconnect Primary Power Source for a Minimum of 15 Seconds and Return to Normal Power. (The above transfer procedure shall not cause a loss of an alarm condition at Receiving Station.)

3.16 EMERGENCY/STANDBY GENERATOR SYSTEM ON-SITE ACCEPTANCE TEST (26 32 13)

- A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

3.17 TESTING CORRECTION OF DEFECTS (26 01 26)

- A. When tests disclose any unsatisfactory workmanship or equipment furnished under this Contract, correct defects and retest. Repeat tests until satisfactory results are obtained.
- B. When any wiring or equipment is damaged by tests, repair or replace such wiring or equipment. Test repaired items to ensure satisfactory operation.

END OF SECTION 26 00 20

SECTION 26 00 30 - EXISTING SYSTEMS AND EQUIPMENT**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 4. General Conditions. |
| 2. General Provisions of the Contract. | 5. Supplementary Conditions. |
| 3. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. Contractor shall perform all work on all existing systems and equipment that require expansion, relocation, modification, and/or repairs as per the drawings and/or specifications

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 RELOCATED OR SERVICED EQUIPMENT

- A. From the time that the equipment is disconnected, or taken out of service, until the time that the equipment is started up and commissioned, the equipment shall be the responsibility of the contractor. Any damage occurring during the disconnecting, storing, relocating, re-installing or start-up shall be repaired by the contractor so that the condition of the equipment will be at least as good as when disconnected in the judgment of the engineer.
- B. Contractor is responsible to ascertain and submit in writing to the engineer operating condition of existing equipment prior to being taken out of service. If contractor fails to provide a report on the condition and operation – of the existing equipment, then it will be assumed that the existing equipment was fully functional, and operating correctly at its full intended capacity at the time of being taken out of service.
- C. Accessory items necessary for the proper operation of existing relocated equipment shall be relocated and re-installed per manufacturer's recommendations. The contractor shall verify proper operation of such accessories before disconnecting the equipment. Notify engineer of any accessory items which need to be replaced before relocating the equipment.

3.02 EXPANDED SYSTEMS

- A. Any existing system which is expanded as a part of this project shall be expanded per the sizes indicated in the contract documents.
- B. Materials used for the expansion of any existing system shall meet the specifications and shall also meet the requirements of local codes.
- C. Commissioning of any expanded system means the commissioning of the entire system, both the existing and new components.

3.03 OWNER FURNISHED EQUIPMENT

- A. Provide rough-ins and final connections to all Owner furnished equipment including switchgear, circuitry, services, etc. necessary to connect up equipment after it has been installed in place.
- B. Install all electrical items furnished loose with all Owner furnished equipment.

END OF SECTION 26 00 30

SECTION 26 00 40 - TEMPORARY FACILITIES AND CONTROLS**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
1. Temporary utilities include, but are not limited to, the following:
 - a. Electric power service.
 - b. Lighting.
 - c. Telephone service.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service overhead, unless otherwise indicated.
- C. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements.
 2. If the Owner's permanent lighting is used at anytime during construction, then at the end of construction (defined by Owner's Acceptance of "Substantial Completion") the contractor shall furnish all new lamps in all permanent light fixtures.
 3. Note: Contractor shall request and allow engineer to examine all cartons of the new lamps before the new lamps are installed at end of construction.
- D. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install two telephone lines for each field office.
1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
 2. At each telephone, post a list of important telephone numbers including police and fire departments, Contractor's home office, Architect's office, Owner's office, Principal subcontractor's field and home offices.
 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- E. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail in field office.

END OF SECTION 26 00 40

SECTION 26 01 26 - TESTING**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. Provide testing of electrical components and systems:
- | | |
|--|--|
| 1. Insulation resistance test. | 2. Phase relationship verification. |
| 3. Grounding electrode test. | 4. Fire alarm acceptance test (where system is specified). |
| 5. Continuity test. | 6. Voltage test. |
| 7. Emergency/Standby Generator System (where system is specified). | |
- B. Provide test reports.
C. Provide correction of defective components or systems.
D. Provide retest of corrected components, systems.

1.03 SUBMITTALS

- A. See Section 26 00 20 - "Contract Close-out & Commissioning".

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Furnish all equipment, manpower and casual labor to perform specified testing.

PART 3 - EXECUTION

3.01 PREPARATION

- A. When temporary electrical service is used for testing, do not energize any equipment or portion of permanent system that exceeds capacity of temporary service.
B. Ensure that all electrical work is complete and ready for testing.
C. Disconnect all devices or equipment that might be damaged by application of test voltages, voltage of reversed phase sequence or other test procedures.

3.02 TESTING

- A. Conduct tests and adjust equipment to verify compliance with specified performance.

3.03 CONTINUITY TESTS

- A. See Section 26 00 20 - "Contract Close-out & Commissioning".

3.04 VOLTAGE TESTS

A. See Section 26 00 20 - "Contract Close-out & Commissioning".

3.05 PHASE RELATIONSHIP

A. See Section 26 00 20 - "Contract Close-out & Commissioning".

3.06 FIRE ALARM ACCEPTANCE TEST

A. See Section 26 00 20 - "Contract Close-out & Commissioning".

3.07 ON-SITE ACCEPTANCE TEST (EMERGENCY/STANDBY GENERATOR SYSTEM)

A. See Section 26 00 20 - "Contract Close-out & Commissioning".

3.08 CORRECTION OF DEFECTS

A. See Section 26 00 20 - "Contract Close-out & Commissioning".

END OF SECTION 26 01 26

SECTION 26 05 19 - WIRES & CABLES**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Conditions.
 3. Supplementary Conditions.

1.02 WORK INCLUDES

- A. Provide wiring and cables including, but not limited to, feeders, branch circuit power, and lighting.
B. Provide electrical connections to all equipment unless noted otherwise.

1.03 SUBMITTALS

- A. No submittals required when using specified materials. Otherwise, Division 26 Section 26 00 10 "SUBMITTALS".

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Wire, cable and installation thereof shall be in accord with the NEC and standards specified.
 2. All materials shall be new, without blemish or defect and UL listed or labeled.
 3. Test power and signal wire and cable according to Section 26 00 20 - "CONTRACT CLOSE-OUT & COMMISSIONING".

1.05 REFERENCES

- A. Specified references, or cited portions thereof, govern the work.
B. National Electrical Manufacturers Association (NEMA):
1. WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 2. WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 3. WC 7 - Cross-Linked-Thermosetting-Polyethylene-Insulated. Wire and Cable for the Transmission and Distribution of Electrical Energy.
- C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code Latest Edition.
D. Underwriters Laboratories, Inc. (UL): Listed and labeled materials.
E. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.
B. Store materials on site in clean, dry storage area.
C. Handle all materials carefully to preclude damage. Material with damaged insulation shall not be acceptable for use.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Building Wire
- | | |
|---------------------------|-------------------------------------|
| 1. Cerro Wire LLC | 2. Phelps Dodge International Corp. |
| 3. Southwire Co. | 3. Prysmian Wire & Cable. |
| 5. General Electric Co. | 4. Sigma Corra-Clad (MC Cable). |
| 7. Okonite. | 5. Encore Wire and Cable. |
| 9. Senator Wire and Cable | |
- B. Joints and Splices - Indent Type Pressure Connector for #8 AWG and Smaller
- | | |
|--------------|--------------------|
| 1. Buchanan. | 2. Ideal. |
| 3. Burndy. | 4. Thomas & Betts. |
- C. Joints and Splices - Insulated Spring Compression Connectors for #10 Awg and Smaller
- | | |
|----------------------------|-------------------|
| 1. Buchanan, Bcap. | 2. T & B, Piggy. |
| 3. Ideal, Wing nut. | 4. 3M, Scotchlok. |
| 5. ITT Holub, Free Spring. | |
- D. Joints and Splices - Mechanical Compression or Bolted Type Connector for #6 Awg or Larger
- | | |
|-------------------------|----------------------|
| 1. AMP, Inc. | 2. Ideal Industries. |
| 3. Anderson. | 4. ITT Weaver. |
| 5. Blackburn. | 6. O.Z./Gedney Co. |
| 7. Burndy Corp. | 8. T & B. |
| 9. General Electric Co. | 10. 3M Co. |
- E. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 BUILDING WIRE

- A. Thermoplastic insulated building wire: NEMA WC 5, UL-83 ICEA S-61-402 or S-66-524.
1. a. Copper.
 - b. Stranded conductor/#8 or larger.
 - c. Solid conductor/#10 or smaller.
 - d. 600 volt insulation THHN/THWN.
- B. MC Flexible Armored Cables:
1. MC & MC-Lite® Metal Clad Cable.
 - a. Armor: Galvanized Steel, aluminum.
 - b. Conductors: Solid/Stranded Copper.
 - c. Conductor Insulation: THHN/XHHW.
 - d. Assembly Covering: Mylar® Tape.
 - e. Maximum Temperature Rating: 90°C (dry).
 - f. Grounding: Insulated Green Grounding Conductor.
 - g. Maximum Voltage Rating: 600V.
 2. MC/IG® Isolated Ground Cable:
 - a. Armor: Aluminum.
 - b. Conductors: Solid/Stranded Copper.
 - c. Conductor Insulation: THHN.
 - d. Assembly Covering: Mylar® Tape.
 - e. Maximum Temperature Rating: 90°C (dry).
 - f. Grounding: Insulated Green and Green with Yellow Stripe Grounding Conductors
 - g. Maximum Voltage Rating: 600V.

- C. Color code conductor insulation for #8 AWG or smaller. Conductor color shall be per current NEC Standards for existing or remodeled systems. Standard colors:
- | | | | | |
|------------|----------------|----------------|----------------|----------------|
| | 120/240V | 120/208V | 120/208V | 277/480V |
| | <u>1 phase</u> | <u>1 phase</u> | <u>3 phase</u> | <u>3 phase</u> |
| 1. Phase A | Black | Black | Black | Brown |
| 2. Phase B | Red | Red | Red | Orange |
| 3. Phase C | N/A | N/A | Blue | Yellow |
| 4. Neutral | White | White | White | Gray |
| 5. Ground | Green | Green | Green | Green |
- D. Provide 1" wide taped, colored bands at panelboards, cabinets, and boxes for sizes larger than #8 AWG. Identify both phase and circuit numbers at these locations.

2.03 JOINTS & SPLICES

- A. Make terminations, taps and splices with an indent type pressure connector with insulating cover for #8 AWG and smaller.
- B. Instead of indent type connectors, insulated spring compression connectors may be used for #10 AWG and smaller.
- C. Use mechanical compression or bolted type connector for #6 AWG or larger. Cover connector with insulating tape or heat shrinkable insulation equivalent to 150% conductor insulation.

PART 3 - EXECUTION

3.01 BASIC WIRING

- A. All power wiring shall be installed in a raceway.
- B. Use no wire smaller than #12 AWG for power and lighting circuits.
- C. Use no smaller than #14 AWG for control wiring for fused control circuits.
- D. Multiwire branch circuits with a “shared neutral” are NOT allowed for single phase circuits.
The only allowed multiwire branch circuit with a “shared neutral” is a multi-pole individual branch circuit to a single piece of equipment (for example “current carrying conductors that share a common yoke”). Each allowed multiwire branch circuit shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point where the branch circuit originates.
- E. Splice only in accessible junction or outlet boxes. Do not splice in panelboard cabinets and gutters.
- F. Neatly train and lace wiring inside boxes, equipment and panelboards.
- G. Make conductor lengths for parallel circuits equal.
- H. All equipment circuits shall be installed in separate conduits.

3.02 GROUNDING

- A. All branch circuits on the project shall have an equipment grounding conductor routed with the circuit conductors. This means that all conduits must have a “green” wire installed in them and sized in accordance with table 250-122 of the NEC (latest edition).
- B. Dependence on the conduit system for grounding is not acceptable.

3.03 WIRING IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling #4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from weather, all plumbing, heating and ventilating work likely to injure conductors completed, conduit system is complete and interior of raceway cleaned.

3.04 CONNECTIONS AND TERMINATIONS

- A. Identify each conductor in panelboards, junction or pull boxes, or troughs with a permanent pressure sensitive label with suitable numbers or letters for easy recognition. Identify control wiring at each end and in junction boxes with numeric wire number corresponding to control wiring diagram. See Section 26 05 53 - "ELECTRICAL IDENTIFICATION", for identification requirements.
- B. Thoroughly clean wire before installing lugs and connectors.
- C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- D. Terminate spare conductors with electrical tape and roll up in box.

3.05 FIELD QUALITY CONTROL

- A. See Section 26 00 20 - "Contract Close-out & Commissioning".

3.06 BUILDING WIRE INSTALLATION SCHEDULE

- A. All Branch Circuit Wiring: In EMT (not below grade) or RGS conduit, copper, stranded conductor, 600 volt insulation THHN/THWN. (Exception: wire sizes #10 AWG and smaller shall be solid).
- B. Optional Branch Circuit Wiring: Copper, flexible cable systems may be used with the following conditions:
 - 1. For concealed branch circuit wiring, SEE "ALLOWABLE RACEWAY INSTALLATION" DETAIL.
 - 2. Note" Home runs with Type MC and MC/IG cable are not allowed. SEE "ALLOWABLE RACEWAY INSTALLATION" DETAIL.
- B. Feeders: In EMT (not below grade) or RGS conduit, copper, stranded conductor, 600 volt insulation THHN/THWN. (Exception: Wire sizes #10 AWG and smaller shall be solid.)
- C. Control circuits: Copper, solid or stranded conductor, 600 volt insulation, THHN/THWN.

END OF SECTION 26 05 19

SECTION 26 05 26 - SECONDARY GROUNDING**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. Provide power system grounding for service. B. Provide equipment grounding.

1.03 RELATED WORK

- A. Section 26 05 33 - "RACEWAYS". B. Section 26 01 26 - "TESTING".
C. Section 26 05 19 - "WIRES AND CABLES".

1.04 SUBMITTALS

- A. Test data. Comply with Division 26 Section 26 00 10" SUBMITTALS".

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Comply with National Electric Code, Latest Edition.
 2. Comply with Public Authorities having jurisdiction.

1.06 SYSTEM DESCRIPTION

- A. Ground electrical service neutral at service entrance equipment to the electrode system.
B. Ground raceways and electrical equipment.
C. Bond together system neutrals, service entrance enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, plumbing and fire protection systems.
D. Bond all interior metal piping systems per the National Electric Code.

1.07 REFERENCES

- A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
B. National Fire Protection Association (NFPA): NFPA 70 National Electrical Code (NEC) Latest Edition.
C. Underwriters Laboratories, Inc. (UL): All products UL listed and labeled.
D. Manufacturers' Catalogs: Specification manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Ground rods: steel, copper-encased, ¾ in. O.D., minimum length 10 ft
B. Connections: bronze clamps.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide a system ground and equipment grounding provisions as shown on plans, and as specified in this section. Comply with NEC Article 250.
- B. Main service grounding electrode shall consist of all of the following:
 - 1. A concrete encased conductor at the footing as detailed on drawing.
 - 2. Metal cold water pipes where the underground portion of the main water pipe is at least 10 feet long. Install a flexible copper bonding jumper around the water meter.
 - 3. All connections to the grounding electrode shall be of the exothermic type.
- C. Equipment grounding provisions shall consist of the following:
 - 1. Exposed, noncurrent-carrying metal parts of fixed equipment likely to become energized, including the following, shall be grounded (bonded):
 - a. Electrical distribution and control equipment enclosures, frames, cabinets, and cutout boxes.
 - b. Metal raceways and boxes.
 - c. Wiring devices.
 - d. Motor frames and enclosures.
 - 2. Cord and plug connected equipment, except for double insulated appliances and other exceptions allowed by the National Electrical Code, shall be grounded.
- D. Equipment grounding conductors shall comply with the following requirements:
 - 1. An equipment grounding conductor shall be installed in all branch circuit and feeder raceways.
 - 2. Ground wires shall be run inside the same raceways as the circuit conductors and shall have green insulation of the same type as the circuit conductors. Ground wires shall be bonded to all boxes and equipment enclosures through which they pass and at each end of metal raceways by means of grounding bushings.

3.02 FIELD QUALITY CONTROL

- A. See Section 26 00 20 - "Contract Close-out & Commissioning."

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAYS**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

A. The following shall apply to this section:

- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. Provide raceways for all conductors, including, but not limited to, that required for service, feeders, branch circuit power, and lighting.
- B. Provide power raceways to connecting point for all equipment. Make final electrical connections unless noted otherwise.
- C. Provide identification of all raceways.

1.03 SUBMITTALS

- A. No submittals required when using specified materials. Otherwise, comply with General Conditions, and Applicable Supplementary Conditions, Architectural Division Section "SUBMITTALS", and Division 26 Section 26 00 10 "SUBMITTALS".
- B. EXCEPTION: Provide submittals on "FIRESTOPPING" materials.

1.04 QUALITY ASSURANCE

- A. Provide all new materials, without blemish or defect, in accord with standards specified and UL listed or labeled.

1.05 SYSTEM DESCRIPTION

- A. Raceways Include:
- | | |
|---|---|
| 1. Rigid Metal conduit and fittings. | 2. Rigid non metallic conduit and fittings. |
| 3. Intermediate metal conduit and fittings. | 4. Liquidtight flexible metallic tubing and fittings. |
| 5. Flexible metallic conduit and fittings. | 6. Surface metallic raceway system. |
| 7. Liquidtight Flexible conduit and fittings. | 8. Electrical metallic tubing and fittings. |

1.06 REFERENCES

- A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
- B. American National Standards Institute (ANSI):
1. C80.1 – Rigid Steel Conduit, Zinc coated.
 2. C80.3 – Electrical Metallic Tubing, Zinc coated.
 3. C80.4 – Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.
- C. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA): FB 1 – Fittings and Supports for Conduit.
- D. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA): ANSI C1/NEPA 70 – National Electrical Code, Latest Edition.
- E. Federal Specifications (FS):
1. FS-WW-C-563 – Electrical Metallic Tubing (EMT).
 2. FS-WW-C-581 – Galvanized Rigid Conduit (GRS).
- F. National Electrical Manufacturers Association (NEMA):
1. NEMA TC-3 – PVC Fittings for use with Rigid PVC Conduit and Tubing.

- G. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be suitably packaged by manufacturers to prevent damage during shipment. Damaged materials will not be acceptable for use.
- B. Store materials on site in clean, dry storage area or, if outside, elevated above grade and covered.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Raceways
- | | |
|-------------------------------|--------------------------------|
| 1. Allied Tube and Conduit. | 2. Republic Steel. |
| 3. Anaconda. | 4. Robintech. |
| 5. B-line. | 6. Steelduct Conduit Products. |
| 7. Carlon. | 8. Square D. |
| 9. Certain-Teed Corp. | 10. Triangle. |
| 11. Electri-Flex. | 12. Walker. |
| 13. ETP. | 14. Wheatland Tube. |
| 15. International Metal Hose. | 16. Wiremold. |
| 17. Jones & Laughlin Steel. | 18. Youngstown Steel. |
- B. Fittings
- | | |
|------------------|----------------|
| 1. Carlon. | 2. O.Z./Gedney |
| 3. Crouse-Hinds. | 4. RACO. |
| 5. Killark. | 6. Steel City. |
- C. Conduit Sealing
- | | |
|--|-----------------------|
| 1. Chase Technology-CTC, PR-855. | 2. T & B – Flamesafe. |
| 3. Dow Corning – Silicone RTV foam 3-6548. | 4. 3M – Fire Barrier. |
| 5. Nelson – Flameseal. | |
- D. Conduit Supporting Devices
- | | |
|----------------------|------------------|
| 1. Minerallac. | 2. Crouse-Hinds. |
| 3. Midwest Electric. | 4. T & B. |
- E. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 RACEWAYS

- A. Conduit:
- Steel Rigid Metal: Comply with ANSI C80.1, FS-WW-C-581 and UL-6.
 - Intermediate Metal: Comply with ANSI C80.1, FS-WW-C-581 and UL-6.
 - Steel Flexible Metal: Comply with FS-WW-C-566 and UL-1.
 - Steel Liquidtight Flexible: Comply with FS-WW-C-566 and UL-1.
 - Rigid Nonmetallic: Comply with NEMA TC-2, PVC, Schedule 40.
- B. Tubing:
- Steel Electrical Metallic (EMT): Comply with ANSI C80.3, FS-WW-C-563 and UL 797.
- C. Surface metallic raceway:
- Comply with UL E4376 and E41751.

2.03 FITTINGS

- A. Rigid and IMC Conduit fittings and conduit bodies:
- Comply with ANSI C80.4, ANSI/NEMA FB 1, threaded type.
 - Locknuts; steel or malleable iron.
 - Bushings; insulating or insulated throat type.

4. Couplings; threaded or gland compression malleable iron type. Set screw or indenter type not acceptable.
 5. UL listed hazardous location fittings (with sealing compound).
- B. Electrical Metallic Tubing fittings and conduit bodies:
1. Couplings and Connectors shall be set-screw or compression type. "Indenter" type couplings or connectors will not be approved. Provide a green ground wire for the complete length of each and every feeder and branch circuit conduit. Comply with ANSI/ NEMA FB 1. See 3.04 G. below.
 2. Bushings; insulating or insulated throat type.
- C. Flexible conduit fittings and conduit bodies:
1. Connectors; malleable iron, threadless, squeeze clamp type for non-jacketed conduit.
 2. Connectors; steel or malleable iron compression type with insulated throat and "O" ring assembly for liquid tight conduit.
 3. Comply with ANSI/NEMA FB 1.
- D. Nonmetallic conduit fittings and conduit bodies:
1. Comply with NEMA TC 3.

2.04 FIRESTOPPING

- A. Where conduits and/or electrical devices penetrate fire-rated walls, floors, and any other fire rated assembly the cavity shall be sealed with intumescent material capable of expanding 5 to 10 times when exposed to temperatures of 250° F. It shall be ICBO, BOCA, and SBCCI (NRB 243) approved ratings per ASTM E-814 (U.L. 1479). Acceptable materials: DOW-CORNING 3-6548 silicone RTV foam or 3-M fire barrier caulk, or 3-M fire barrier 2001 silicone RTV foams.

2.05 CONDUIT SEALING

- A. Thermal Seal:
1. Seal the penetrations of thermally insulated equipment (such as walk-in coolers or freezers) or rooms to prevent heat transfer. Seal the exterior of raceway with Armaflex pipe insulation and caulk. Seal the interior of raceway at entry to equipment or room with explosion-proof seal fittings filled with U.L. listed sealing compounds.
- B. Water Seal:
1. Seal penetrations of perimeter walls or floors below grade to prevent entry of water. Use materials compatible with wall or floor construction and reviewed by Engineer's Representative. Use pre-manufactured fittings.
 2. Seal penetrations of roof with flashings compatible with roof design and reviewed by Roofing System Manufacturer and Engineer's Representative.
- C. Hazardous Location Seal:
1. Install conduit sealing fitting on conduits entering the hazardous location. Fill fittings with sealing compound.
 2. Install conduit sealing fittings on conduits entering devices within the hazardous location.

2.06 RACEWAY SUPPORTING DEVICES

- A. Suspended conduits less than 1 inch.
1. For exposed construction, provide strap type hangers supported from beam clamps or threaded rods.
 2. For conduits suspended above ceilings, anchor to building structural steel. When span exceeds NEC limits, provide channel steel between framing members. Tie wiring of conduit to air ducts, ceiling grid or support or other piping not permitted. Plumber's perforated strap not permitted.
- B. Suspended Conduit 1 inch or larger.
1. Provide threaded rod with "U" type hangers for single conduit.
 2. Provide trapeze hanger assemblies with Unistrut P-1000, Huskey HP-200 or Kindorf B-901 and threaded rod for two or more conduits. Anchor conduits to hanger assembly with split pipe clamps.
 3. Anchor threaded rod to inserts in concrete or beam clamp on steel structure.
- C. Surface Mounted Conduit:
1. Provide one-hole galvanized steel straps for conduits one inch or less manufactured by Appleton, Steel City or RACO. Provide clampbacks on exterior walls below grade or in wet areas.

2. For conduit larger than one inch and all exterior surfaces, use malleable iron pipe straps.
 3. For multiple conduits, provide channel anchored to wall with conduit attached to channel with split pipe clamps.
- D. Surface Metallic Raceways
1. Provide two-hole straps matching raceway.
- E. Anchoring:
1. Hollow Masonry: Toggle bolts or spider type expansion anchors.
 2. Solid Masonry: Lead expansion anchors or preset anchors.
 3. Concrete: Self-drilling anchor or powder driven studs.
 4. Metal: Machine screws, bolts or welded studs.
 5. Wood: Wood screws.

PART 3 – EXECUTION

3.01 INTERFERENCES

- A. Coordinate work with other trades so that interference between piping, equipment, structural and electrical work will be avoided.
- B. When interference develops, Engineer's Representative will decide which equipment will be relocated; regardless of which apparatus was installed first.

3.02 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. In general, conduit shall be concealed within walls, ceilings, and floors. Conduit in spaces such as electrical/mechanical equipment rooms may be exposed.
- B. Size conduit for conductor type installed; ¾ in. minimum size.
- C. Arrange conduit to maintain headroom and present a neat appearance.
- D. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- E. Maintain minimum 6 in. clearance between conduit and un-insulated piping. Maintain 12 in. clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
- F. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- H. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.
- I. Do not support conduit or boxes directly from the roof deck unless specifically shown to be so installed on the drawings or unless specifically permitted by the engineer.
- J. Do not route or install conduit on or above any roof unless such installation is specifically called for on the drawings or unless it is specifically approved in advance of installation by the engineer.
- K. Route each conduit run as directly as possible. Do not "Daisy Chain" conduits through unrelated boxes.

3.03 CONDUIT INSTALLATION

- A. All conduit in finished spaces shall be concealed unless otherwise noted.
- B. Cut conduit square using a saw or pipe cutter; de-burr cut ends.
- C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- D. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
- E. Install no more than the equivalent of four 90-degree bends between boxes. (Two 90-degree bends for telephone conduits, data conduits, and sound system conduit.)
- F. Use conduit bodies to make sharp changes in direction, as around beams.
- G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 in. size.
- H. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

- I. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- J. Provide No. 12 AWG insulated conductor or nylon pull string in empty conduit, except sleeves and nipples.
- K. Provide UL listed expansion-deflection joints where conduit crosses building expansion or seismic joints.
- L. Where conduit penetrates fire-rated walls and floors, provide mechanical fire-stop fittings with UL listed fire rating equal to wall or floor rating, or, at contractor's option, seal opening around conduit in accordance with paragraph 2.04.
- M. Route conduit through roof openings for piping, HVAC units, and ductwork where possible. Provide flashing making waterproof joints where conduits must pass through roof or roofing membrane.
- N. Maximum Size Conduit to be installed within floor slabs: $\frac{3}{4}$ in. Do not route conduits to cross each other in slabs. Run larger conduits below floor slabs or above ceilings.
- O. Thermally seal conduit where conduits leave heated area and enter unheated area. See 2.04.
- P. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

3.04 CONDUIT INSTALLATION SCHEDULE

- A. Underground Installations (outdoors): Rigid steel conduit, Plastic-coated rigid steel conduit, or Schedule 40 PVC conduit.
- B. Installations In or Under Concrete Slab on Grade: Use only Schedule 40 PVC conduit with RGS elbows where penetrating the floor surface. Also use RGS elbows where changes in horizontal conduit route, with a radius of less than 6' are made.
- C. In Slab Above Grade: Schedule 40 PVC conduit.
- D. Exposed Outdoor Locations: Rigid Steel Conduit or Intermediate Metal Conduit.
- E. Interior Locations Above Floor Slabs: Rigid steel conduit, Intermediate metal conduit, or Electrical metallic tubing. "M.C." and flexible metallic conduit (Greenfield) allowed only in accessible locations per plans.
- F. Where nonmetallic conduit is used in or below slab or underground, continue the conduit runs above slab or grade using EMT, IMC or RGS as appropriate for the space the conduit is in. Transition from PVC to metal conduit shall be made by a RGS fitting located below or within the slab.
- G. Provide a green insulated equipment grounding conductor in all feeder and branch circuit raceways. Size conductor according to NEC Section 250-95.
- H. Connections to ballasted lighting fixtures, within same room, electric outlets and devices within same room, food service equipment, appliances, and equipment with motors or compressors: Metal Clad Cable "M.C.". Liquidtight flexible conduit in exterior locations in wet locations, and in grease laden areas such as food service areas. Provide green insulated equipment grounding conductor. M.C. cable may only be used for connection to fixtures, devices and equipment within same room and shall not be used for any part of a home run to a panel.
- I. Branch circuits serving patient care areas, like an examining room, shall not be installed in a metal raceway or listed cable having a metallic armor or sheath that qualifies as an effective ground-fault current path in accordance with 250.118 [517.13(A)]. In addition, the branch circuit wiring method must contain an insulated equipment grounding/bonding conductor in accordance with 517.13 (B). The metal armored sheath of Type AC listed as a suitable ground-fault current path because it contains an internal bonding strip in direct contact with the metal sheath of the cable [250.118(8)]. However, the outer metal sheath of standard interlocked Type MC cable is not listed as a ground-fault current path [250.118(11)]: therefore, it shall not be used to supply branch circuits in patient care areas of health care facilities.
- J. Hazardous Locations: Intermediate metal conduit or Rigid steel conduit.
- K. Interior exposed locations in finished spaces: surface metallic raceway system.

END OF SECTION 26 05 33

SECTION 26 05 34 - BOXES**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Conditions.
 3. Supplementary Conditions.

1.02 WORK INCLUDES

- A. Provide all boxes for the work.
B. Provide coordination of boxes requiring access with General work.
C. General Construction Trades provide access panels for boxes hidden by building construction.

1.03 SUBMITTALS

- A. No submittals required when using specified materials. Otherwise, comply with Division 26 Section 26 00 10 "SUBMITTALS".

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements
1. Comply with NFPA. National Electric Code.
 2. National Electric Code.
 3. Provide materials listed/labeled by UL.

1.05 SYSTEM DESCRIPTION

- A. Boxes include:
1. Wall and ceiling outlet boxes.
 2. Pull and junction boxes.

1.06 REFERENCES

- A. Specified references, or cited portions thereof, govern the work.
B. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA OS-1-Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports).
C. National Electrical Manufacturers Association (NEMA): NEMA 250 - Enclosures for Electrical Equipment.
D. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code Latest Edition.
E. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials not acceptable for use.
B. Store materials on site in clean, dry storage area.
C. Handle all materials carefully to preclude damage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Boxes
- | | |
|-------------------------------|------------------------|
| 1. Appleton Electric Co. | 2. Pyle-National |
| 3. Crouse-Hinds Co. | 4. RACO |
| 5. General Electric Co. | 6. Square D. |
| 7. Hoffman Co. | 8. Steel City |
| 9. Hubbell. | 10. Thomas & Betts Co. |
| 11. Killark Electric Mfg. Co. | 12. Walker. |
| 13. O.Z./Gedney Co. | 14. Quazite. |
- B. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 PULL BOXES AND JUNCTION BOXES

- A. Comply with 1996 NEC - 370, UL 50 and ANSI/NEMOS 1; galvanized steel.
- B. Flush mounted pull boxes: Overlapping cover with flush head retaining screws, prime-coated.
- C. Surface mounted boxes: Screw-on or hinged cover. Provide silicon bronze standard retaining screws.
- D. Finished Areas: Boxes of 14 gauge steel minimum, galvanized or prime coated.
- E. Boxes greater than 144 square inch: Make of 1- ½ in. X 1- ½ in. X ¼ in. galvanized angle covered with 10 gauge galvanized sheet steel riveted or bolted with hinged cover of 11 gage galvanized steel.
- F. Boxes larger than 12 inches in any dimension: hinged enclosure.
- G. Exterior Below Grade: Non-metallic, sand-gravel polymer base fiberglass reinforced.

2.03 OUTLET BOXES

- A. Hot dipped galvanized, 1.25 oz. per sq. ft., sherardized or cadmium plated. Conform to UL 514.
- B. Interior boxes: Sheet steel with conduit knockouts, attached lugs for locating. ANSI/NEMA OS 1.
- C. Exterior boxes or exposed interior in wet/damp locations: Cast aluminum, deep type, corrosion proof fasteners, watertight, gasketed, threaded hubs.
- D. For suspended or surface mounted fixtures:
- 4-inch octagonal or square according to devices used. Minimum 1- ½ in. deep. Furnished with fixture studs. Installed with ¾ in. minimum depth plaster rings on suspended ceilings. 4 in. octagonal or square for all exposed conduit work with fixture extension pan or deep fixture canopy to enclose the box.
 - Fixtures listed for thru-way wiring may be used as such without an outlet box.
- E. For recessed fixtures:
- 4 in. octagonal or square. Minimum 1- ½ in deep. Complete with blank cover.
 - Fixtures listed for thru-way wiring may be used as such without an outlet box.
- F. Switch and Receptacle Boxes:
- Wall: 4 in. square for up to two devices. Single gang with 18 cubic inch minimum capacity for one device. Solid gang boxes for two devices. Complete with 1 in. minimum depth tile ring where used in exposed tile, paneled walls. Complete with 1 in. minimum depth plaster ring where used in plastered walls. Install with ½ in. raised galvanized device covers conduit work. Provide concrete-tight masonry boxes in poured concrete or CMU walls.

2.04 CONDUIT BODIES

- A. Galvanized cast metal of type, shape and size to fit location.
- B. Constructed with threaded conduit ends, removable cover, corrosion resistant screws.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Provide boxes as shown and for splices, taps, wire pulling, equipment connections and code compliance.
- B. Locations shown are approximate unless dimensioned. Verify location of boxes and outlets prior to rough-in.
- C. Locate boxes to allow access. When inaccessible, provide access doors.
- D. Locate boxes to maintain headroom and present a neat appearance.

3.02 INSTALLATION

- A. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- B. Support all boxes independently of conduit except for cast boxes connected to two rigid conduits both supported within 12 inches of box.
- C. Floor Boxes:
 - 1. Confirm exact placement with related work before installing. Set level and flush with finish floor. Securely anchor box to avoid movement during concrete pour.
 - 2. Securely anchor to floor box.
- D. Outlet Boxes:
 - 1. Flush mount outlet boxes in areas other than mechanical rooms, electrical rooms, and above removable ceilings.
 - 2. Do not install boxes back-to-back in same wall. Provide at least 6 in. separation where possible.
 - 3. Masonry Walls:
 - a. Adjust position of outlets in finished masonry walls to suit masonry course lines.
 - b. Coordinate cutting of walls to achieve neat openings for boxes.
 - c. Locate boxes in walls so that only corner need be cut from masonry units.
 - d. Use only concrete tight masonry boxes in all masonry walls.
 - 4. Use multiple gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate different voltage systems.
 - 5. For boxes mounted in exterior walls, make sure insulation is behind outlet boxes. Do not damage insulation.
 - 6. For outlets mounted above counters, benches, or backsplashes, coordinate location and mounting heights with units. Where boxes are mounted on sidewalls at counters and lavatories, hold boxes to front of counter or lavatory for handicapped accessibility.
 - 7. Adjust outlet mounting height to agree with specified location for equipment served.
 - 8. Position outlets to locate luminaires as shown on reflected ceiling drawings.
 - 9. Position outlets and junction boxes in inaccessible ceilings areas within 6 in. of luminaire; accessible through luminaire ceiling opening.
 - 10. Provide recessed boxes in finished areas; secure to interior wall and partition studs, allow for surface finish thickness. Use stamped steel stud hangers in hollow stud wall, and adjustable steel channel fasteners for flush ceiling boxes.
 - 11. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
 - 12. Provide cast boxes for exterior locations & wet locations.
- E. Pull and Junction Boxes:
 - 1. Locate above accessible ceilings or in unfinished areas.
 - 2. Support independent of conduit.
- F. Provide covers for all boxes.

END OF SECTION 26 05 34

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Conditions.
 3. General Provisions of the Contract.
 4. Supplementary Conditions.
 5. Solicitation Documents.
 6. Architectural Division.

1.02 WORK INCLUDES

- A. Provide identification of manual and automatic operable equipment:
1. Safety Switches.
 2. Panelboards & Switchboards.
 3. Starters.
 4. Control panels, relay panels, and special junction boxes.
 5. Contactors, relays and time switches.
 6. Manual starters and interval timers.
 7. Device Plates (where required).
- B. Provide identification of all passive equipment:
1. Terminal Cabinets.
- C. Provide identification of conduit system including boxes.
- D. Provide identification of wiring system.

1.03 QUALITY ASSURANCE

- A. Comply with:
1. ANSI A 13.1, Identification of Piping Systems.
 2. Local Rules & Regulations.
 3. National Electric Code. (NEC)

1.04 REFERENCES

- A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
- B. American National Standards Institute (ANSI): ANSI A13.1 - Identification of Piping Systems.
- C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC) Latest Edition.
- D. Underwriters Laboratories, Inc. (UL): All products UL listed and labeled.
- E. Manufacturers' Catalogs: Specification manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.05 SUBMITTALS

- A. See Division 26 Section 26 00 10 "SUBMITTALS".

PART 2 - PRODUCTS

2.01 EQUIPMENT IDENTIFICATION PLATES

- A. See Section 26 00 20 - "Contract Close-out & Commissioning".

2.02 CONDUIT SYSTEM IDENTIFICATION

- A. See Section 26 00 20 - "Contract Close-out & Commissioning".

2.03 UNDERGROUND-TYPE PLASTIC LINE MARKERS

- A. General: Manufacturer's standard permanent, bright-colored, continuous-printed detectable tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried conduit.
 - 1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.04 WIRING SYSTEM IDENTIFICATION

- A. Wire Insulation Color: See Section 26 05 19 - "WIRES AND CABLES".
- B. Code all wire and cable larger than color coded sizes available from manufacturer by application of electrical plastic tape in colors specified. Apply tape in uniform manner circling wire or cable. Apply tape in all boxes and cabinets. Half-lap tape for length of cable as required by Local Authorities or NEC. Tape shall be 3M, Plymouth or Permacel.
- C. Maintain consistent coding throughout installation to ensure proper phase identification.
- D. See Section 26 00 20 - "Contract Close-out & Commissioning".

2.05 MISCELLANEOUS IDENTIFICATION

- A. Complete all panel directories completely typewritten. Each circuit shall be identified by location and type of load. Example: Lighting - Office.
- B. Provide device plates with engraved identification of the panelboard and circuit number supplying receptacles where such identification is required by the National Electrical Code.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Affix Equipment Identification Plates to equipment with stainless steel self tapping screws. Do not use adhesive.

3.02 UNDERGROUND PIPING IDENTIFICATION

- A. General: During back-filling/top-soiling of underground conduits, install continuous underground-type detectable type line marker, located directly over buried line at 6" to 8" below finished grade.

END OF SECTION 26 05 53

SECTION 26 24 16 - ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
 - 1. Drawings.
 - 2. General Conditions.
 - 3. Supplementary Conditions.

1.02 WORK INCLUDES

- A. Provide:
 - 1. Panelboards.
 - 2. Safety Switches.
 - 3. Contactors.
 - 4. Fuses.
 - 5. Transformers
 - 6. TVSS Equipment
 - 7. Other Equipment Specified Herein

1.03 SUBMITTALS

- A. Architectural Division Section "SUBMITTALS" - Shop drawings, product data, installation drawings; also see Division 26 Section 26 00 10 "SUBMITTALS".
- B. Architectural Division Section "PROJECT RECORD AND CLOSEOUT DOCUMENTS" - Complete record of "as-built" drawings and specifications for all components.
- C. Panelboard submittals shall include overall dimensions, wiring gutter dimensions, location of the main, branches, and neutral.

1.04 QUALITY ASSURANCE

- A. Regulatory requirements:
 - 1. Panelboards:
 - a. UL Standard 67.
 - b. Fed. Spec. W-P-115A Type 1, Class 1.
 - c. NEMA Standards PBI-1977.
 - 2. Safety Switches:
 - a. UL Std. 98.
 - b. NEMA Std. KS1-1975.
 - 3. Contactors:
 - a. UL Std. 508.
 - b. NEMA Std. 1CSZ-Z11B.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in time to maintain approved construction schedule.
- B. Store in safe, dry location. Protect from dust, moisture, weather and extreme temperatures.
- C. Follow manufacturer's recommendation for transportation, handling and storage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Electrical Equipment
 - 1. Eaton/Cutler-Hammer.
 - 2. Siemens-ITE.
 - 3. GE.
 - 4. Square D.

- B. Transient Voltage Surge Suppressors (TVSS)
1. Control Concepts IG Series
 - a. Accuvar
 - b. ACV120Y111RKE
 2. Advanced Protection Technologies (Square D)
 - a. TE/PG Series
 3. Leviton
 - a. Main panels – Series #42,000
 - b. Branch panels – Series #32,000.
 4. Hubbell
 - a. HBL – W100 (NF) Series
 - b. HBL-P100 Series
 - c. HBL-W65 Series
 5. Cutler-Hammer
 - a. SPD Series
 6. Lea International
 - a. LS110
 7. United Power
 - a. Main panels-CPX3-S1-040K-34-L
 - b. Branch panels-CPX3-S1-020K-34-L
 8. Intermatic
 - a. Main Panels-PG3000 Series
 - b. Branch Panels-PG2500 Series
 9. EFI
 - a. Line Master, OMNI-Phase Model #OSW,OSE
- C. Fuses
1. Bussman.
 2. Ferraz Shawmut.
 3. Yaskawa.
- D. Variable Frequency Drives
1. Yaskawa.
- E. Elevator Power Modules
1. Eaton/Cutler-Hammer.
 2. Bussman.
- F. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 PANELBOARDS - LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

- A. Branch circuit panelboards shall meet the following specifications:
1. NEMA PB 1 – Panelboards
 2. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 3. NEMA AB 1 - Molded Case Circuit Breakers
 4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
 5. UL 50 - Enclosures for Electrical Equipment
 6. UL 67 – Panelboards
 7. UL 98 - Enclosed and Dead-front Switches
 8. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
 9. Federal Specification W-P-115C - Type I Class 1
 10. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.
 11. NFPA 70 - National Electrical Code (NEC)
 12. ASTM - American Society of Testing Materials
- B. Panelboard Interior
1. Panelboard shall be 120Y/208 Vac maximum or 480Y/277 Vac maximum. Continuous main current ratings, as indicated on associated schedules, not to exceed 600 amperes maximum for main breaker panelboards and not to exceed 800 amperes for main lug panelboards.
 2. The interrupting capacity of the panelboards may be achieved by the series-rating method unless the drawings call for rating by the fully-rated method.
 3. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bus bar shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.

4. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
 5. A solidly bonded aluminum equipment ground bar shall be provided. An additional aluminum isolated/insulated ground bar shall also be provided.
 6. Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cable may be of the same length. UL Listed panelboards with 200% rated solid neutral shall be plated aluminum for non-linear load applications. Panelboards shall be marked for non-linear load applications.
 7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twistouts covering unused mounting space.
 8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
 9. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 125A interiors shall be vertically mounted. Main circuit breakers over 125A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
 10. Interior phase bus shall be pre-drilled to accommodate field installable options. (i.e., Sub-Feed Lugs, Sub-Feed Breakers, Thru-Feed Lugs)
 11. Interiors shall accept 125 ampere breakers in group mounted branch construction.
- C. Main Breaker
1. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
 2. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
 3. Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
 4. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
 5. Lugs shall be UL Listed to accept solid or stranded [copper and aluminum conductors] [copper conductors only]. Lugs shall be suitable for [75° C rated wire] [90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16]. Lug body shall be bolted in place; snap-in designs are not acceptable.
 6. The circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.
- D. Branch Circuit Breakers
1. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the panelboard schedules.
 2. Molded case branch circuit breakers shall have bolt-on type bus connectors.
 3. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
 4. There shall be two forms of visible trip indication. The circuit breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red indicator appearing in the clear window of the circuit breaker housing.
 5. The exposed faceplates of all branch circuit breakers shall be flush with one another.
 6. Lugs shall be UL Listed to accept solid or stranded copper conductors only. Lugs shall be suitable for 75°

- C rated wire.
7. Breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch as shown on the drawings
 8. Breakers shall be UL Listed with the following ratings: (15-125A) Heating, Air Conditioning, or Refrigeration (HACR), (15-30A) High Intensity Discharge (HID), or (15-20A) Switch Duty (SWD).
 9. All branch circuits that supply 125-volt, single-phase, 15- and 20-ampere outlets (lighting and receptacles) installed in dwelling unit bedrooms shall be protected by an arc-fault circuit interrupter listed to provide protection of the entire branch circuit.
 10. If mounting hardware is required for installation of circuit breakers in vacant spaces, such hardware shall be factory-installed in the Panelboard.
- E. Enclosures
1. Type 1 Boxes
 - a. Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvannealed steel will not be acceptable.
 - b. Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
 - c. Box width shall not exceed 26" wide.
 2. Type 1 Fronts
 - a. Front shall meet strength and rigidity requirements per UL 50 standards. Shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
 - b. Fronts shall be hinged 1-piece with door. Mounting shall be flush or surface as indicated on associated schedules.
 - c. Panelboards rated 250 amperes and below shall have flat fronts with concealed door hinges and trim screws. Front shall not be removable with the door locked. Panelboards rated above 250 amperes shall have vented fronts with concealed door hinges. Doors on front shall have rounded corners; edges shall be free of burrs.
 - d. Front shall have flat latch type lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
 3. Type 3R Fronts
 - a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
 - b. All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59 inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
 - c. Maximum enclosure dimensions shall not exceed 21" wide and 9.5" deep.

2.03 PANELBOARDS - DISTRIBUTION CIRCUIT BREAKER

- A. Branch circuit panelboards shall meet the following specifications:
1. NEMA PB 1 – Panelboards
 2. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 3. NEMA AB 1 - Molded Case Circuit Breakers
 4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
 5. UL 50 - Enclosures for Electrical Equipment
 6. UL 67 – Panelboards
 7. UL 98 - Enclosed and Dead-front Switches
 8. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
 9. Federal Specification W-P-115C - Type I Class 1
 10. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.
 11. NFPA 70 - National Electrical Code (NEC)

12. ASTM - American Society of Testing Materials
- B. Panelboard Interior
1. Shall be rated 600 Vac or 250 Vdc maximum. Continuous main current ratings as indicated on associated schedules not to exceed 1200 amperes maximum. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67.
 2. Provide UL Listed short circuit current ratings (SCCR) as indicated on the associated schedules not to exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 RMS symmetrical amperes. Main lug and main breaker panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230.VI and VII.
 3. The panelboard interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
 4. The bussing shall be fully rated with sequentially phased branch distribution. Bus bar shall run the entire length of the bus bar. The entire interleaved assembly shall be contained between two (2) U-shaped steel channels, permanently secured to a galvanized steel-mounting pan by fasteners.
 5. Interior trim shall be of dead-front construction to shield user from all energized parts. Main circuit breakers through 800 amperes shall be vertically mounted. Main circuit breaker and main lug interiors shall be field convertible for top or bottom incoming feed.
 6. A solidly bonded aluminum equipment ground bar shall be provided. An additional aluminum isolated/insulated ground bar shall also be provided when called for on the drawings.
 7. Solid neutral shall be equipped with a full capacity bonding strap for service entrance applications. UL Listed panelboards with 200% rated solid neutrals shall have plated copper neutral bus for non-linear load applications. Gutter-mounted neutral will not be acceptable.
 8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label, and Short Circuit Current Rating shall be displayed on the interior or in a booklet format. Leveling provisions shall be provided for flush mounted applications.
- C. Group mounted circuit breakers through 1200A.
1. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.
 2. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
 3. Circuit breakers equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breakers shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breakers of different frame sizes shall be capable of being mounted across from each other.
 4. Line-side circuit breaker connections are to be jaw type.
 5. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
- D. Thermal magnetic molded case circuit breakers
1. Molded case circuit breakers shall have integral thermal and instantaneous magnetic trip in each pole.
 2. Circuit breakers shall be standard interrupting. Ampere ratings shall be as shown on the drawings.
* Manufacturer shall submit one set of published I_p and I^2t let-through curves (as required by UL) to the owner.
 3. All branch circuits that supply 125-volt, single-phase, 15- and 20-ampere outlets (lighting and receptacles) installed in dwelling unit bedrooms shall be protected by an arc-fault circuit interrupter listed to provide protection of the entire branch circuit.
- E. Enclosures
1. Type 1 Boxes
 - a. Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Zinc-coated galvanized steel will not be acceptable.
 - b. Boxes shall have removable blank end walls and interior mounting studs. Interior support bracket shall be provided for ease of interior installation.

- c. Maximum enclosure dimensions shall be 44" wide and 9.5" deep.
2. Type 1 Trim Fronts
 - a. Trim front steel shall meet strength and rigidity requirements per UL 50 standards. Shall have an ANSI 49 medium gray enamel electrodeposited over cleaned phosphatized steel.
 - b. Trim front shall be hinged 1-piece with door available in flush or surface mount as called for on the drawings. Trim front door shall have rounded corners and edges free of burrs. A clear plastic directory cardholder shall be mounted on the inside of the door.
 - c. Locks shall be cylindrical tumbler type with larger enclosures requiring sliding vault locks with 3-point latching. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.
3. Type 3R
 - a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
 - b. All doors shall be gasketed and be equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners. A clear plastic directory cardholder shall be mounted on the inside of door. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.
 - c. Maximum enclosure dimensions shall not exceed 44" wide and 14.5" deep.

2.04 SAFETY SWITCHES

- A. All safety switches shall be the fusible type, horsepower rated, NEMA type, general duty (240V and below) unless otherwise noted on drawings. Note: Heavy duty safety switches shall be provided on all voltages greater than 240V.
- B. Enclosures shall be code gauge steel with rust inhibiting primer and gray baked enamel finish. Install safety switches with NEMA 1 enclosures in dry locations and NEMA 3R enclosures in wet locations.
- C. Switches shall have quick-make, quick-break operating handle and mechanism which shall be an integral part of the enclosure. Switches shall be lockable in both positions and shall have an interlock to prevent opening switch door with handle in the ON position. This feature shall have a defeater mechanism.
- D. Switch blades shall be visible in OFF position with door open. Switches shall be dead front type with arc suppressors. Lugs shall be UL listed for copper or aluminum. All current carrying parts shall be plated.
- E. Switches shall have a solid neutral unless otherwise noted.
- F. Switches shall have factory installed kits to prevent the use of other than UL class R fuses.

2.05 FUSES

- A. Circuits 601 to 6000 amperes shall be protected by current limiting time-delay fuses. Fuses shall hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriters Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class L.
- B. Circuits 0 to 600 amperes shall be protected by current limiting dual-element fuses. All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F. melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds (30A, 250V Class RK1 case size shall be a minimum of 8 seconds at 500% of rated current) and be listed by Underwriters Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical.
- C. Motor circuits - All individual motor circuits with full load ampere ratings (FLA) of 480 amperes or less shall be protected by dual-element fuses. The fuses shall be UL Class RK1, or J, dual-element time-delay.
- D. The ampere rating of fuses shall be as required by the load served. Field verify by inspecting the nameplate of the equipment being protected.

2.06 DRY-TYPE TRANSFORMERS

- A. Single phase transformers shall be 480 volt primary and 120/240 volt secondary. Three phase transformers shall be 480 volt delta primary and 208Y/120 secondary. Transformers 25 KVA and larger shall have a minimum of

- 4-2.5% full capacity primary taps. Exact voltages and taps to be as designated on the plans or the transformer schedule.
- B. Transformers 15 KVA and above shall be 150°C temperature rise above 40°C ambient. All insulating materials to be in accordance with NEMA ST20 Standard for 220°C UL component recognized insulation system.
 - C. Transformer coils shall be of the continuous wound construction and shall be impregnated with nonhygroscopic, thermosetting varnish.
 - D. All cores to be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall then be no metal-to-metal contact between the core and coil and the enclosure. On transformers 500 KVA and smaller, the vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating systems requiring the complete removal of all fastening devices will not be acceptable.
 - E. Transformers 15 KVA and larger shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code standards for ventilated enclosures. Single phase transformers through 167 KVA, and three phase transformers through 112.5 KVA shall be designed so they can be either floor or wall mounted. Above 112.5 KVA they shall be floor mounted design.
 - F. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above 40° ambient.
 - G. The core to the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.
 - H. Sound levels shall be guaranteed by the manufacturer not to exceed the following:

15 to 50 KVA - 45DB	151 to 300 KVA - 55DB
51 to 150 KVA - 50DB	301 to 500 KVA - 60DB

The allowable sound level shall be based on the specified size of the transformer; if a larger transformer is furnished, it shall meet the sound level requirements of the specified size. Transformers that become noisy shall be replaced without charge anytime within the project's one-year warranty period.
 - I. Installation:
 - 1. Concrete house keeping pad of 1 5/8" minimum thickness shall be installed under entire switch gear footprint.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with equipment manufacturer's written installation instructions for all equipment.
- B. Install equipment with minimum of 3'-6" working clearance measured from front of enclosure.
- C. Set equipment true and plumb using a carpenter's level.
- D. Support panels adequately in the same manner as described for outlet boxes for different types of construction.
- E. Wiring within equipment cabinets shall be done in a neat and workmanlike manner with branch circuit conductors run along the outside edges of the wiring gutters and then horizontally into the terminals.
- F. For flush mounted panelboards, stub a minimum of three 3/4" diameter raceways into the ceiling cavity space.
- G. Install safety switches which serve as equipment disconnecting means so that equipment maintenance can be performed within sight of the disconnect if possible.
- H. When safety switches are mounted directly to equipment in wet locations, the installation shall be watertight. Install sealing locknuts with rubber O-rings for equipment with knockouts.
- I. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A.
- J. Adjust operating mechanisms for free mechanical movement.
- K. Touch-up scratched or marred surfaces to match original finishes.
- L. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.

- M. Prior to energization of equipment, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.
- N. Prior to energization, check equipment for electrical continuity to circuits, and for short-circuits.
- O. Subsequent to wire and cable hook-ups, energize equipment and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.
- P. See Section 26 00 20 - "Contract Close-out & Commissioning".
- Q. Fuses shall not be installed until equipment is ready to be energized.

3.02 MISCELLANEOUS IDENTIFICATION

- A. Complete all panel directories completely typewritten. Each circuit shall be identified by location and type of load. Example: Lighting - Office.
- B. Provide device plates with engraved identification of the panelboard and circuit number supplying receptacles where such identification is required by the National Electrical Code.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. Provide:
- | | |
|-----------------|-------------------|
| 1. Switches. | 2. Device plates. |
| 3. Receptacles. | |

1.03 RELATED WORK

- A. Section 26 05 19 – “WIRES AND CABLES”. B. Section 26 05 34 – “BOXES”.

1.04 SUBMITTALS

- A. Provide product data in accordance with General Conditions, Applicable Supplementary Conditions, Architectural Division Section “SUBMITTALS”, and Division 26 Section 26 00 10 “SUBMITTALS”.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: All materials: U.L. listed or labeled.

1.06 REFERENCES

- A. Specified references, or cited portions thereof, current at date of bidding documents unless otherwise specified, govern the work.
- B. National Electrical Manufacturers Association (NEMA):
- | | |
|---|--|
| 1. WD-1 - General Purpose Wiring Devices. | 2. WD-5 - Specific Purpose Wiring Devices. |
|---|--|
- C. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC) Latest Edition.
- D. Underwriters' Laboratories, Inc. (UL): All materials UL listed and labeled.
- E. Federal Specification WC596F (Receptacles) and WS896E (Switches).
- F. Manufacturers' Catalogs: Specified manufacturers' catalogs are incorporated by reference to same force and effect as if repeated herein in full.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be suitably packaged by manufacturer to prevent damage during shipment. Damaged materials will not be acceptable for use.
- B. Store materials on site in clean, dry storage area.
- C. Handle all materials carefully to preclude damage during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- | | |
|---------------------------|-------------------|
| A. Cooper Wiring Devices. | B. Leviton. |
| C. Hubbell. | D. Pass & Seymour |

- E. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 WALL SWITCHES

- A. Specification Grade, 20A, 120-277 V., quiet type, back and side wired, toggle handle. Color – per plans. Equal to Hubbell construction series, heavy duty as follows:
1. Single pole - #1221
 2. Double pole - #1222
 3. 3-Way - #1223
 4. 4-Way - #1224
 5. Pilot Light Switch - #HBL-1221PL

2.03 RECEPTACLES

- A. Duplex:
1. Flush, straight blade, 3 wire grounding, construction series, heavy duty, specification grade, 20 A, 125 V., NEMA 5-20R, capable of being split wired and/or feed thru.
 2. Hubbell #5362X, or equal.
 3. Color: per plans.
- B. Tamper Resistant Duplex:
1. Flush, tamper resistant, straight blade, 3 wire grounding, 20 A, 125 V., NEMA 5-20R, capable of being split wired and/or feed thru.
 2. Hubbell #CR20X, or equal.
 3. Color: per plans.
- C. Ground Fault Circuit Interrupter:
1. Commercial, specification grade feed through type capable of protecting downstream receptacles on same circuit, grounding type, UL class A-Group 1, 20 amp 125 v.
 2. Solid State ground fault sensing and signaling, 5 ma. trip level.
 3. Color: per plans.
 4. Hubbell #GF-20XLA, or equal.
- D. Isolated Ground:
1. Single or duplex, 3 wire, construction series, heavy duty specification grade, 20 amp. 125V, NEMA 5-20R.
 2. Color: per plans.
 3. Hubbell CR-5352IGGY, or equal.
- E. Telephone/Communication Outlet:
1. Provide wall box only and provide blank coverplate for locations that are not used.
- F. Special Device:
1. Provide special and/or custom-selected devices as may be called for on the drawings. Include any necessary accessories or special cover plates required for a complete installation.

2.04 DEVICE PLATES

- A. Materials:
1. Finished Spaces: .04 inch thick, type 302, satin finished stainless steel.
 2. Outdoor, Exterior: Cast metal, gasketed. Provide springloaded gasketed door for receptacles. Cover to provide weather proof protection with cord and plug in use.
 3. Surface Devices in Unfinished Areas: Galvanized steel.
- B. Use plates manufactured by device manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install wall switches with OFF position down.
- B. Install convenience receptacles with grounding pole on top when mounted vertically or with grounding pole on left when mounted horizontally.

- C. Install plates on all switch, and receptacle outlets. Install blank plates on all unused boxes.
- D. Install devices and plates flush and level.
- E. Provide device plates with engraved identification of the panelboard and circuit number supplying receptacles as required by the National Electrical Code, 110.22.
- F. Seal all connections on GFCI devices with seal coat compound and wrap with two layers tape.

END OF SECTION 26 27 26

SECTION 26 29 00 - MOTOR CONTROL**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Architectural Division. |

1.02 WORK INCLUDES

- A. Provide starters specified and shown on electrical drawings.

1.03 RELATED WORK

- | | |
|---|---|
| A. Section 26 05 33 - "RACEWAYS". | B. Section 26 24 00 - "ELECTRICAL EQUIPMENT". |
| C. Section 26 05 19 - "WIRES AND CABLES". | D. Section 26 01 26 - "TESTING". |
| E. Section 26 05 53- "ELECTRICAL IDENTIFICATION". | |

1.04 SUBMITTALS

- A. Product data in accord with General Conditions Article, Applicable Supplementary Conditions, Architectural Division Section "SUBMITTALS", and Division 26 Section 26 00 10 "SUBMITTALS".
1. Provide catalog cut sheets showing voltage, controller size, ratings and size of switching and overcurrent protection devices, short circuit ratings, dimensions, and enclosure details.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements
- | | |
|---|--------------------|
| 1. Power & Control Wiring in accord with N.E.C. | 2. NEMA, NEMA KS1. |
|---|--------------------|

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- | | |
|----------------------|--|
| A. General Electric. | B. Square D. (used as the standard for selection below – 2.02 Motor Controllers) |
| C. Siemens. | D. Eaton. |
- E. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 MOTOR CONTROLLERS

- A. Manual Motor Controller
1. NEMA (M-0, M-1, M1P), AC general-purpose Class 2510 manually operated, full-voltage controller with overload element, red pilot light, auxiliary contact, where noted, and push button operator.
- B. Fractional Horsepower Manual Motor Controller
1. NEMA Type (FG1P, FG2P), AC general-purpose Class 2510 manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.
- C. Magnetic Motor Controllers - Non-reversing
1. NEMA Type S, AC general-purpose Class 8536 magnetic controller for induction motors rated in horsepower with 120 volt encapsulated coil, poles and size as scheduled or as indicated.

2. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
 3. Wiring: Straight-through wiring with all terminals clearly marked.
 4. Overload Relay: NEMA Type S; with one-piece thermal unit construction. Thermal units shall be interchangeable. Overload relay control circuit contact shall be replaceable. Thermal units shall be required for starter to operate.
 5. Auxiliary contacts, pilot devices and other options as scheduled or as indicated. As a minimum provide a H-O-A (Hand-Off-Auto) switch.
 6. All controller enclosures shall be as scheduled or indicated.
- D. Disconnect Switch Type Combination Magnetic Motor Controllers - Non-reversing
1. Combine magnetic motor controllers with fusible switch disconnect in common enclosure. Switch shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON-OFF with red and black color coding.
 - a. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses and visible blades. Operating handle shall give positive visual indication of ON-OFF with a color coded operating handle.
 2. NEMA Type S, AC general-purpose Class 8538 magnetic controller for induction motors rated in horsepower with 120 volt encapsulated coil, poles and size as scheduled or as indicated.
 3. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
 4. Wiring: Straight-through wiring with all terminals clearly marked.
 5. Overload Relay: NEMA Type S; with one-piece thermal unit construction. Thermal units shall be interchangeable. Overload relay control circuit contact shall be replaceable. Thermal units shall be required for starter to operate.
 6. Auxiliary contacts, pilot devices and other options as scheduled or as indicated. As a minimum, provide a H-O-A (Hand-Off-Auto) switch.
 7. All controller enclosures shall be as scheduled or indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.
- B. Install enclosed controllers plumb with 5 ft. AFF to operating handle.
- C. Install fuses in fusible switches under provisions of fuses section. If not specified, use Class "R" fuses.
- D. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- E. Provide engraved plastic nameplates under the provisions of Section 26 05 53 - "ELECTRICAL IDENTIFICATION".
- F. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION 26 29 00

SECTION 26 50 00 - LIGHTING**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Conditions.
 3. Supplementary Conditions.

1.02 WORK INCLUDES

- A. Provide lighting fixtures.
- B. Provide required fixture supports.
- C. Provide lamps.

1.03 SUBMITTALS

- A. Product data in accord with Division 26 Section 26 00 10 "SUBMITTALS".

1.04 QUALITY ASSURANCE

- A. Regulatory requirements.
1. NEMA Std. Pub. Nos. SH5 and TT1 for pole construction, materials, and hardware.
 2. Building lighting fixtures:
 - a. Applicable sections of NEC.
 - b. ANSI 132.1
 - c. UL 57, 676, 1570, 1571, and 1572.
 - d. Fluorescent ballasts shall be CBM labeled.
 - e. NEMA Std. Pub. Nos. FA1, LE1 and LE2.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Electronic ballasts
1. Advance.
 2. Osram.
 3. Venture.
- B. Lamps
1. General Electric.
 2. Phillips.
 3. Osram- Sylvania.
 4. Venture.
- C. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 FIXTURES

- A. Specified on plans.

2.03 BALLASTS

- A. All ballasts shall be rated for the circuit voltage shown on plans.
- B. All ballasts shall be P thermal rating. Fluorescent ballasts shall have class A sound rating
- C. Ballasts for exterior lighting fixtures shall be suitable for use at temperatures -20°F. and above.

- D. Unless otherwise noted, fluorescent ballasts shall be solid state electronic type for use with T8 (Octron or equal) fluorescent lamps. Electronic ballasts shall have a total harmonic distortion of 20% or less.

2.04 LAMPS

- A. Provide lamps for all light fixtures as scheduled on drawings.
- B. All lamps shall be energy-saving models where these will meet the photometric requirements of the fixture as specified. In no case shall the furnished lamps be of a higher wattage than those specified.
- C. For H.I.D. lamps furnish coated lamps where coated lamps are called for. Do not substitute clear lamps for coated.
- D. All fluorescent lamps shall contain mercury in reduced amounts allowing them to pass the EPS's "Toxic Characteristic Leaching Procedure" (TCLP) and be so labeled.

PART 3 - EXECUTION

3.01 LIGHTING FIXTURES

- A. Provide all plaster frames, angles, channel, hangers and supports required to support lighting fixtures. Fixtures shall be supported independently of ceiling.
- B. Exit signs in suspended ceiling areas shall be located in the center of the ceiling tile and oriented so as to provide maximum visibility to escape paths.
- C. See Section 26 00 20 - "Contract Close-out & Commissioning".
- D. Exit light – Signs shall be listed to U.L. Standard 924. Exit frame, backplate, faceplate and mounting canopy shall be of rugged high impact thermoplastic construction in off-white. Exit sign knockouts are on the top and side for canopy mounting, and a universal knockout pattern is on the back.
1. Light Source: shall be high intensity light emitting diodes (LED) lamps shall provide illumination in normal and emergency operation. LED lamps shall be mounted inside the exit housing, not on the face. An LED sensitive ink diffuser shall be mounted in front of the LED's to provide a full ¾" letter stroke with even illumination.
 2. Chargers – shall be fully automatic, solid state, temperature compensated and short-circuit proof.
 3. Batteries – shall be completely sealed maintenance-free. Construction shall be nickel cadmium for long life.
 4. Circuitry – shall include a combination LED pilot light and test switch.
- E. Emergency light - Unit shall be fully automatic, self-contained, maintenance-free and tested to UL Standard 924.
1. Circuitry: shall include a 120/277 volt dual input transformer, automatic charging/instantaneous transfer, test switch, long life LED AC charge monitor light. The charger shall utilize a computer tested integrated circuit which samples the battery in relation to its temperature, state of charge and input voltage fluctuations. The charger shall be current limited, temperature compensated, short-circuit proof and reverse polarity protected. The charger shall recharge the battery to rated capacity as per UL's Emergency Lighting Standard 924. Electrical features shall include: Low Battery, Voltage Disconnect. Brownout protection and Battery lockout.
 2. Battery: shall be 6 volt, maintenance-free and have starved electrolyte in a sealed case. To prevent loss of electrolyte through gassing, the battery shall operate by the principle of electrolyte recombination.
 3. Housing/Heads and Lens: The housing/heads shall be constructed of high impact, UL recognized, 94V-0 thermoplastic. The unit shall resist denting, peeling, scratching and corrosion. Lamps shall be high intensity all-glass wedge base. The transparent lens shall be constructed of polycarbonate. Alternate lamp sockets shall be provided to adjust photometric pattern.

END OF SECTION 26 50 00

SECTION 28 31 00 - FIRE ALARM SYSTEM**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
1. Drawings.
 2. General Conditions.
 3. General Provisions of the Contract.
 4. Supplementary Conditions.
 5. Solicitation Documents.
 6. Architectural Division.

1.02 WORK INCLUDES

- A. Provide fire alarm system as shown on plans and herein specified.
B. Provide cable and conduit for complete operating system.
C. Fees, Permits, and Licenses. (See Section 26 00 10, 1.03, "Work Includes...")

1.03 RELATED WORK

- A. Section 26 05 33 - "RACEWAYS". B. Section 26 05 53 - "ELECTRICAL IDENTIFICATION".
C. Section 26 05 19 - "WIRES AND CABLES". D. Section 26 01 26 - "TESTING".
E. Section 26 05 34 - "BOXES".

1.04 SUBMITTALS

- A. Product data in accord with General Conditions and Applicable Supplementary Conditions, Architectural Division Section "SUBMITTALS", and Division 26 Section 26 00 20 "SUBMITTALS".
B. Shop drawings shall include but not be limited to the following:
 1. Wiring schematic for project building showing equipment/device locations and wiring connection diagrams for entire system, including riser diagrams.
 2. A complete point to point wiring diagram of all devices including terminal connections to individual modules in the Control Panel.
 3. Clear description and complete data for each device being furnished.
 4. NEMA, F.M., UL listings.
 5. Rough-in boxes.
 6. Provide emergency battery backup calculations for alarm and standby conditions. See paragraph 2.02, C. for times required.

1.05 QUALITY ASSURANCE

- A. Source quality control:
 1. Ensure all equipment is new and of current design and manufacture.
 2. All control equipment to be solid state.
 3. All equipment shall meet ADA requirements.
 4. All equipment shall be UL listed.
 5. NFPA-72A.
- B. All equipment shall be installed by workmen with a minimum of 4 years experience in the installation of similar equipment.
- C. **SYSTEM SHALL BE FULLY OPERATIONAL, TESTED, AND A MANUFACTURER'S WRITTEN CERTIFICATION ISSUED BEFORE BUILDING IS OCCUPIED.**

1.06 SYSTEM DESCRIPTION

- A. Provide a supervised, **ADDRESSABLE**, automatic local fire alarm and detection system. Initiating devices shall include manual pull stations, ceiling smoke detectors, and duct smoke detectors (see below) as indicated on

drawings. Alarm devices shall be horns and flashing visible alarms and visible only where indicated. Interlock system with ventilation equipment as shown on plans. Interlock system with remote annunciator panel where shown on plans.

- B. The integrated fire alarm system shall be fully programmable and shall not depend on zones for annunciation of alarms. The system of wiring shall allow for expansion without modification of the main panel other than programming. No end-of-line resistors shall be required. All devices in the system shall be identifiable at the main panel.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver equipment in time to maintain approved construction schedule.
- B. Store in safe, dry location. Protect from dust, moisture, weather and extreme temperatures.
- C. Follow manufacturer's recommendation for transportation, handling and storage.

1.08 MAINTENANCE AND SERVICE

- A. Except as required by warranty provision, no maintenance or service is included in this Contract.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Gamewell.
- B. Notifier
- C. Edwards
- D. Simplex/Grinnell
- E. Faraday
- F. Siemens
- G. Fire Control Instruments
- H. Silent Knight
- I. Any design changes necessitated by the use of equipment other than from the manufacturers listed in the equipment schedules, are the responsibility of the contractor. See Specifications, Section 20 01 00, 1.06-F.

2.02 SYSTEM OPERATION

- A. Actuation of any alarm initiating device shall cause the following to occur:
 1. Continuously sound all alarm devices until fire alarm system is cleared or silenced.
 2. All controlled air handling equipment shall shut down.
 3. Flash an alarm lamp in the control panel.
 4. Alarm devices may be silenced by an "Alarm Acknowledged" or "Reset" pushbutton on control panel; however, a subsequent alarm shall cause the alarm devices to resound.
 5. Register the location of the alarm on zone annunciators and remote annunciator where indicated.
 6. All doors held open shall be released.
 7. If shown on drawings, activation of the heat detectors in the elevator equipment room or elevator shaft shall operate the elevator shunt trip circuit breaker.
 8. If shown on drawings, activation of any smoke detectors located in the elevator machine room, hoist way or lobby shall provide for a signal (contact closure) for elevator capture. Coordinate with elevator supplier.
 9. Transmit alarm or trouble condition to the Owner's selected central station via commercial telephone lines.
 10. Delayed egress locks shall unlock.
- B. Power failures, opens, grounds, or malfunction of system components shall cause a trouble signal to be registered at the control panel, at the zone annunciators.
- C. System shall operate on 120 VAC power and automatically transfer to standby batteries upon loss of power. Batteries shall have the capability of operating the system in a standby mode with normal power disconnected for at least 24 hours and still be capable of operating the system in an alarm condition for 15 minutes.

2.03 FIRE ALARM CONTROL PANEL

- A. Fire alarm control panel shall be equipped as follows:
 - 1. Semi-flush mounting cabinet complete with an outer door frame assembly which is equipped with a locking door panel.
 - 2. Solid state plug-in modules necessary to meet the job requirements.
 - 3. Alarm control with an acknowledge switch for trouble and alarm, trouble LED, earth ground LED, LED test switch, trouble signal silence switch and alarm reset switch.
 - 4. Internal system test switch which will cause all devices to alarm but not signal the remote station.
 - 5. Battery/Charger Monitor containing an LED and circuit to monitor the battery for low voltage, battery disconnected or charger failure.
 - 6. System must be rated for 20 amps or fused and must have a local on/off reset control.
 - 7. Quantity required of initiating modules capable of operating smoke detectors. Includes separate flashing trouble and alarm LED which glow steadily when the acknowledge switch is depressed. Expandable to twenty.
 - 8. Digital communicator for proprietary station notification.
 - 9. Signal circuits as required by load.
 - 10. Transformer mounted within the control panel cabinet.
 - 11. Power supply as required by alarm device load.
 - 12. Auxiliary relays. Two sets of 4PDT 10 amp contacts.
 - 13. Rechargeable lead acid batteries.
 - 14. Battery charger. Automatic dual rate with a volt/ ammeter to monitor the battery condition and a "Charger Failure" LED.
 - 15. Fan shutdown controls.

2.04 ALARM DEVICES

- A. Unless otherwise noted on plans, alarm devices shall be audible/visible type. Audible alarm shall be a 24 volt DC parallel connected horns with minimum output of 87 dB at 10 feet. Visible alarms shall be a selectable 15, 30, 75 or 110 candela (minimum 177 candela in handicapped sleeping rooms), 24 volt DC lamp with self-contained flasher. Lamp shall be covered by a Lexan lens with "FIRE" factory imprinted. Audible and visible alarm shall be mounted in a common enclosure. 85 dB, Pizeo "mini-horns" may be used where shown. Mini-horns are not allowed except where shown on plans.
- B. Where shown on plans, provide visible alarm devices only.
- C. All signal devices shall meet Americans with Disabilities Act requirements.
- D. Mount at 90" above finish floor unless otherwise specified on plans.

2.05 MANUAL PULL STATIONS

- A. Single action, non-breakglass type initiating station with pull-down lever, flush mounting. Station housing shall be constructed of high impact Lexan, red in color with white lettering.
- B. Mount at a maximum of 48" above finished floor.

2.06 SMOKE DETECTORS

- A. All detectors shall be photoelectric type. Sensitivity of the detectors shall be field adjustable and a check of sensitivity shall be possible while the detector is installed and operating. Detectors shall have flashing light to indicate normal operation. Provide detectors with normally open auxiliary contacts for annunciator circuit.
- B. Duct smoke detectors will have sampling tube and contacts for interlocking the associated air handling equipment fan(s). Duct smoke detectors may be specified under Mechanical Divisions. Coordinate the installation and connection as required.
- C. The detector shall be UL Listed for compatibility with the fire alarm control panel and shall obtain its operating power from the alarm initiating circuit.
- D. Removal of the detector head shall interrupt the supervisory circuit and activate a trouble signal at the control panel. It shall be possible to alarm the duct detector by using the remote stations.

- E. Duct detector shall be furnished with a remote test switch equipped with alarm and power pilot lights.
- F. Ceiling detectors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The detectors shall contain a locking screw to discourage unauthorized removal of the head from the base.
- G. The detectors shall have 30-mesh insect screens, and have completely closed backs to restrict entry of dust and air turbulence. Electronics of the unit shall be completely shielded to protect against false alarms from EMI and RFI. The detector head shall be easily disassembled to facilitate cleaning.
- H. The detectors shall contain a red LED that shall pulse to indicate power on and shall glow continuously to indicate alarm. The detector shall contain a functional test switch (magnetically operated) that, when operated, will test the electronics of the unit and put it into alarm.

2.07 REMOTE ANNUNCIATOR

- A. Remote annunciator shall be the LED type and shall provide the following functions/information:
 - 1. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys, Status LEDs and LCD Display as the FACP.
 - 2. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
 - 3. The LCD shall display a 40 character custom location label, type of device and point status.
 - 4. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACP.

2.08 CABLE

- A. Alarm and initiating circuit wiring and annunciator wiring shall be of type recommended by equipment manufacturer. Cable shall be UL listed for use with local protective signaling systems.
- B. All cable shall be rated for use in air handling ceiling plenum spaces where it is to be installed in such spaces.

2.09 HEAT DETECTORS

- A. Heat detectors shall be the fixed temperature type with 135°F. temperature rating.
 - 1. Heat detectors in hazardous locations shall be explosion proof. Others shall be the "low profile" type, white in color.
 - 2. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

2.10 NAC POWER EXTENDER

- A. The IDNet NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits.
- B. Alarms from the host fire panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All wiring shall comply with NEC Section 760-3 and NFPA Pamphlet 72.
- B. Comply with equipment manufacturer's wiring instructions.
- C. All wiring shall be continuous from terminal to terminal or from terminal to device pigtail lead. Wiring shall be color coded and color coding scheme shall be used consistently.
- D. Fire alarm system wiring shall be in conduit (EMT) wherever exposed below 15'-0" above finish floor. Where permitted by NFPA 72, open wiring may be utilized. Secure all open wiring neatly by approved methods.
- E. Device boxes shall be flush mounted unless noted otherwise.

3.02 INSTRUCT OWNER'S PERSONNEL

A. See Section 26 00 20 - "Contract Close-out & Commissioning.

3.03 CERTIFICATION

A. See Section 26 00 20 - "Contract Close-out & Commissioning."

END OF SECTION 28 31 00

SECTION 33 00 00 - SITE PIPING**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. The following shall apply to this Section:
- | | |
|--|------------------------------|
| 1. Drawings. | 2. General Conditions. |
| 3. General Provisions of the Contract. | 4. Supplementary Conditions. |
| 5. Solicitation Documents. | 6. Division 01. |

1.02 WORK INCLUDES

- A. The basic materials used in the various piping and fluid conveying systems 5'-0" outside the building to the serving utilities point of connection (POC). Unless stated otherwise the following is required:
1. Fire Sprinkler Water System
- B. Gas service, meter and regulator (if used) will be provided by the gas utility company.
- C. Unless noted on the drawings otherwise, work shall include:
1. The procurement of and payment for all fees, permits and licenses required for the performance of the work.
 2. All fees and direct expenses involved in any inspections required for the project.
 3. All hoists, scaffolds, staging, runways, and equipment required for the performance of the work.
 4. All job measurements and shop layouts required for the proper installation of material and equipment included in the work.
 5. All lights, guards, and signs as required by safety regulations applicable to the work.
 6. The removal from the premises, as it accumulates, of all dirt and refuse resulting from the performance of the work.
- D. The work shall include revisions, modifications, and rework of existing work as required for installation of new work, and as required for connections of new work to existing systems, and of existing work to new systems.

1.03 RELATED WORK

- | | |
|--|--|
| A. Architectural Division 01 - "GENERAL REQUIREMENTS". | E. Section 20 06 00- "MECHANICAL IDENTIFICATION REQUIREMENTS". |
| B. Section 20 01 00 - "GENERAL PROVISIONS". | F. Section 21 13 13- "WET-PIPE SPRINKLER SYSTEMS" |
| C. Section 20 03 00 - "MATERIALS AND METHODS". | |
| D. Section 20 04 00 - "TESTING PIPING SYSTEMS" | |

1.04 SUBMITTALS

- A. Submit shop drawings in accordance with Sections 20 01 00 and 20 03 00 for the following:
- | | |
|------------|--------------|
| 1. Valves. | 2. Fittings. |
| 3. Pipe. | |

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Comply with current editions of following, as applicable:
- | | |
|--|-----------------------------|
| 1. National Fire Protection Association NFPA 24. | 4. AWWA and ASTM standards. |
|--|-----------------------------|

1.06 PROTECTION OF EXISTING UTILITIES AND CONDITIONS

- A. The existing utilities and conditions as encountered or as shown on the drawings shall be protected from damage during all construction including the excavation and backfilling of trenches, and, if damaged, shall be repaired by the Contractor at his expense.

1.07 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Follow manufacturer's directions in delivery, storage, protection and handling of all equipment and materials.
- B. Deliver and store equipment and materials to the site in original containers, suitably sheltered from the elements and mechanical injury, but readily accessible for inspection until installed.
- C. Plastic pipe and materials shall be stored under cover and protected from sunlight and heat.

1.08 INTERFERENCES

- A. The Contractor shall confer with other Contractors at the site to avoid interferences. In the event that interferences develop, the Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced piping, valves, etc.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Valve and Valve Boxes
 - 1. Mueller.
- B. Fire Service Valves
 - 1. Mueller.
 - 2. American Foundry.
 - 3. Clow.
 - 4. Waterous/Traverse City.

2.02 PIPING MATERIALS AND APPLICATIONS

- A. The following applications are for only from 5'-0" outside the building to the utility point of connection (POC).
- B. Underground fire protection water piping:
 - 1. 3" and smaller polyvinyl chloride (PVC) pipe, class 200 bell and spigot with rubber sealing ring, (SDR-21, with matching fittings). Provide concrete blocking at all tees and elbows.
 - 2. 4" and larger polyvinyl chloride (PVC) pipe, class 150 bell and spigot with rubber sealing ring conforming to AWWA C900. Fittings shall be ductile-iron conforming to AWWA C111/A21.11 with non-toxic rubber gaskets. Provide concrete blocking at all tees and elbows.
 - 3. Ductile iron pipe, 150 psi working pressure, conforming to ANSI/AWWA C-151/A21.51 with mechanical joint fittings conforming to AWWA C-111/A21.11 with gasket material that is non-toxic, durable and impervious. Provide concrete blocking at all tees and elbows.

2.03 VALVES AND VALVE BOXES

- A. Valves shall be AWWA iron body, bronze mounted, double disc, parallel seat, non-rising stem gate valves with a working pressure of 200 psi. Valves shall be furnished with end connections as required.
- B. Valve boxes shall be cast iron, two-piece, slip or screw type.
- C. Valve and boxes shall be as approved by the water department.

2.04 FIRE HYDRANTS

- A. None required.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILLING**A. General**

1. The underground pipe lines shall be constructed of the materials specified and as shown on the drawings or as directed by the Engineer. The pipe shall be laid true to lines and grades shown on the drawings using batten boards. All pipe which has its grade or joint disturbed or is found to be defective or damaged after laying shall be taken up and relaid or replaced as directed by the Engineer without additional charge. Trenches shall be kept free from water until pipe jointing material has set and pipe shall not be laid when the trench conditions or the weather is unsuitable for such work. At all times when work is not in progress, all open ends of pipe and fitting shall be securely closed to the satisfaction of the Engineer so that no trench water, earth or foreign substances will enter the pipe or fittings.

B. Excavation

1. Perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings. Unless otherwise indicated on the drawings, the minimum cover over the top of the water lines shall be 3'-0". All excavation materials not required for fill or backfill shall be removed from the site, or utilized as directed by the Engineer. All excavation shall be made by open cut. The banks of trenches shall be kept as nearly vertical as practicable and where required, shall be properly sheeted and braced. Trenches shall be excavated true to line and shall not be less than 12" wider nor more than 16" wider than the outside diameter of the pipe to be laid therein. The maximum width of trench specified applies to the width at or below the level of the top of the pipe. The width of the trench above that level maybe made as wide as necessary for sheeting and bracing and the proper installation of the work. The bottom of trenches shall be accurately graded and shaped so that each section of pipe for at least one-third (1/3) of its exterior circumference and for its entire length shall rest firmly on undisturbed soil, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Provide a 4" sand or crushed rock base under all underground piping. Piping shall have 12" of sand or crushed rock cover properly compacted.
2. Where rock, clay, hardpan, or similar formation is encountered, it shall be removed and replaced with suitably selected sand or crushed rock.
3. See the applicable section of these specifications for contract payment provisions for removal of rock.

C. Drainage and Removal of Water

1. The Contractor shall control the grades around all excavations so as to prevent water from running into the excavated areas or tunnels. Any water which accumulates in excavations or tunnels shall be removed promptly. Grading shall be brought to meet existing adjacent grade.

D. Bracing and Shoring

1. This Contractor shall do all shoring and bracing necessary to retain earth banks and prevent caving in and displacement of adjacent soil, furnishing all necessary timbers, cribbing, planking or sheet piling for that purpose. Proper shoring for safety of working is the exclusive responsibility of the contractor.

E. Protection of Existing Utilities

1. All existing utilities shall be protected from damage during the entire construction including the excavation and backfilling of trenches and, if damaged, shall be repaired by the Contractor at his expense.

F. Installation of Pipe

1. Pipe lines shall be laid to the grades and alignment indicated on the drawings or as directed by the Engineer. All pipe lines shall be laid at a constant grade as required by code.
2. Install piping in accordance with the following standards:
 - a. Ductile - iron pipe – AWWA C600.
 - b. Polyvinyl chloride - per manufacturers instructions
3. Provide anchorage for tees, bends, valves, hydrants, etc. Thrust blocks shall be concrete, 2500 psi.

G. Backfilling

1. The trenches shall not be backfilled until all required tests are performed and until the systems, as installed, conform to the requirements of the Specifications. After the trench bottom or bedding has been prepared and the pipe installed, sand or gravel at a moisture content which will facilitate compaction, shall be carefully placed alongside the pipe in layers not exceeding 6" in depth. Care shall be taken to insure thorough compaction of the fill. Each layer shall be thoroughly compacted to 95% proctor density by

- tamping.
2. The remainder of the backfill under pavements, curbs, gutters, sidewalks, and driveways shall consist of sand, gravel, or crushed rock as approved by the Engineer. Rock, broken concrete or pavement, large boulders, and frozen earth shall not be used as backfill material.
 3. The Contractor shall be responsible for backfilling all ditches, trenches or excavation covered by this contract.
- H. Replacement of Pavements, Walks, Curbs, and Lawn Areas.
1. Pavements, walks, streets, curbs, and lawn areas which are cut or damaged during construction of the sewers, gas lines, water lines, etc. shall be replaced and restored to the original conditions by this Contractor.

3.02 LINES, GRADES, AND ELEVATIONS

- A. Sewer lines, grades and elevations shall be laid out with a surveyor's transit and level to offset stakes set to one side of the trench. After the trench is excavated, these lines and grades shall be transferred to a string stretched between batter boards set at 50 ft. intervals across the trench. During the pipe laying, the line shall be determined by hanging a plumb bob from the grade string. The invert of each length of pipe shall be set to the proper elevation by measuring down from the string with a grade rod.
- B. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bedding shall be required for all sewer construction, except ductile iron pipe, and shall be of a minimum thickness equal to 1/4 of the outside diameter of the sewer pipe but shall not be less than four inches (4").
- C. Each section shall be unobstructed, smooth, straight, true, with uniform slope and compliance with this requirement shall be demonstrated to Engineer by arranging for visual inspection by him and by shining a light from one end of the section to the other end.

3.03 FIELD QUALITY CONTROL

- A. Water Line Testing: Before joints are painted or covered, test underground water lines to hydrostatic pressure of at least 150 lbs. psi. Leakage shall not exceed 200 gal. per inch of pipe diameter per mile per 24 hours. Contractor shall be responsible for discovering leaks and making necessary repairs.
- B. Leaks shall be repaired and tests repeated until leakage or infiltration is within above limits.
- C. Substitution of air testing is not permitted.

3.04 CONTINUITY OF SERVICES (UTILITY OUTAGES)

- A. All existing services must be kept in continuous operation with no interruption of services (sewer, water, gas, etc.). Contractor shall install temporary services as required to maintain this continuous operation and shall remove all temporary services when work is completed. Where interruptions are absolutely mandatory, they shall be kept to an absolute minimum and coordinated with Engineer.

3.05 EQUIPMENT INSTALLATION

- A. All valves, valve boxes, etc. shall be installed as detailed and per manufacturer's instructions and recommendations.

END OF SECTION 33 00 00